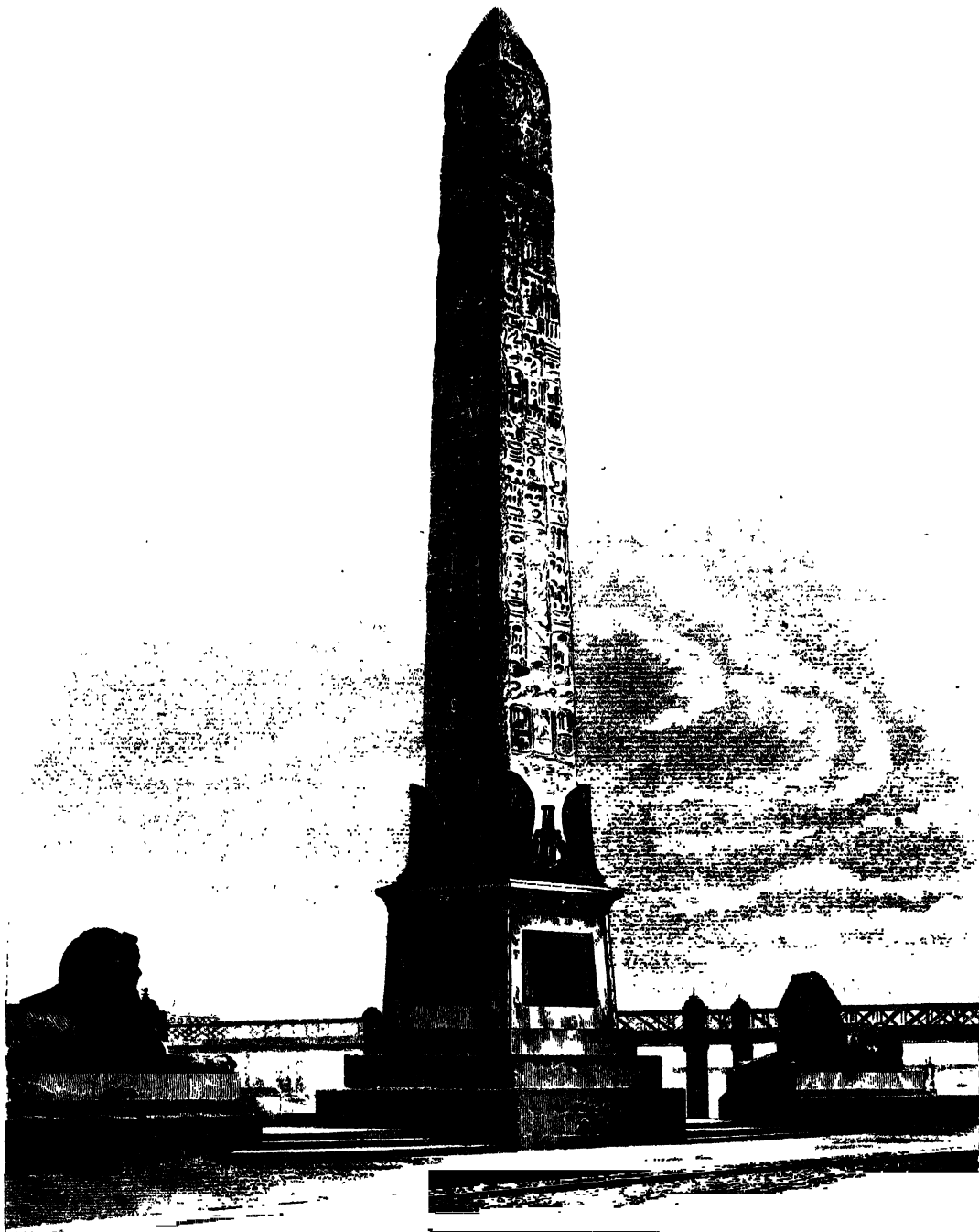
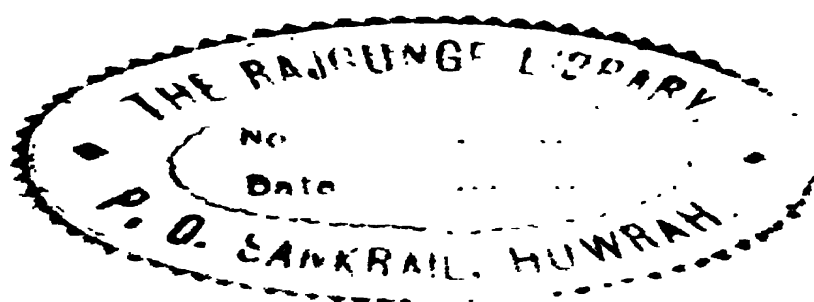


ELISK

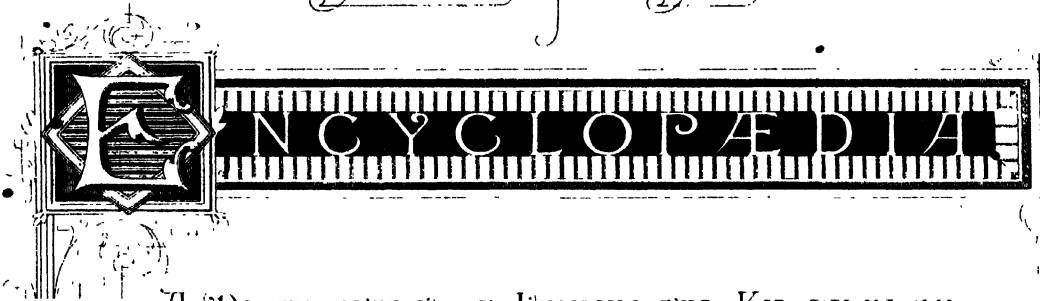


CLEOPATRA'S NEEDLE ON THAMES EMBANKMENT.





The
NATIONAL



A DICTIONARY OF UNIVERSAL KNOWLEDGE.

BY

WRITERS OF EMINENCE IN

LITERATURE, SCIENCE, AND ART

—A—

VOLUME X

LONDON.

WILLIAM MACKENZIE, 69 LUDGATE HILL, E.C.,

EDINBURGH, AND GLASGOW.

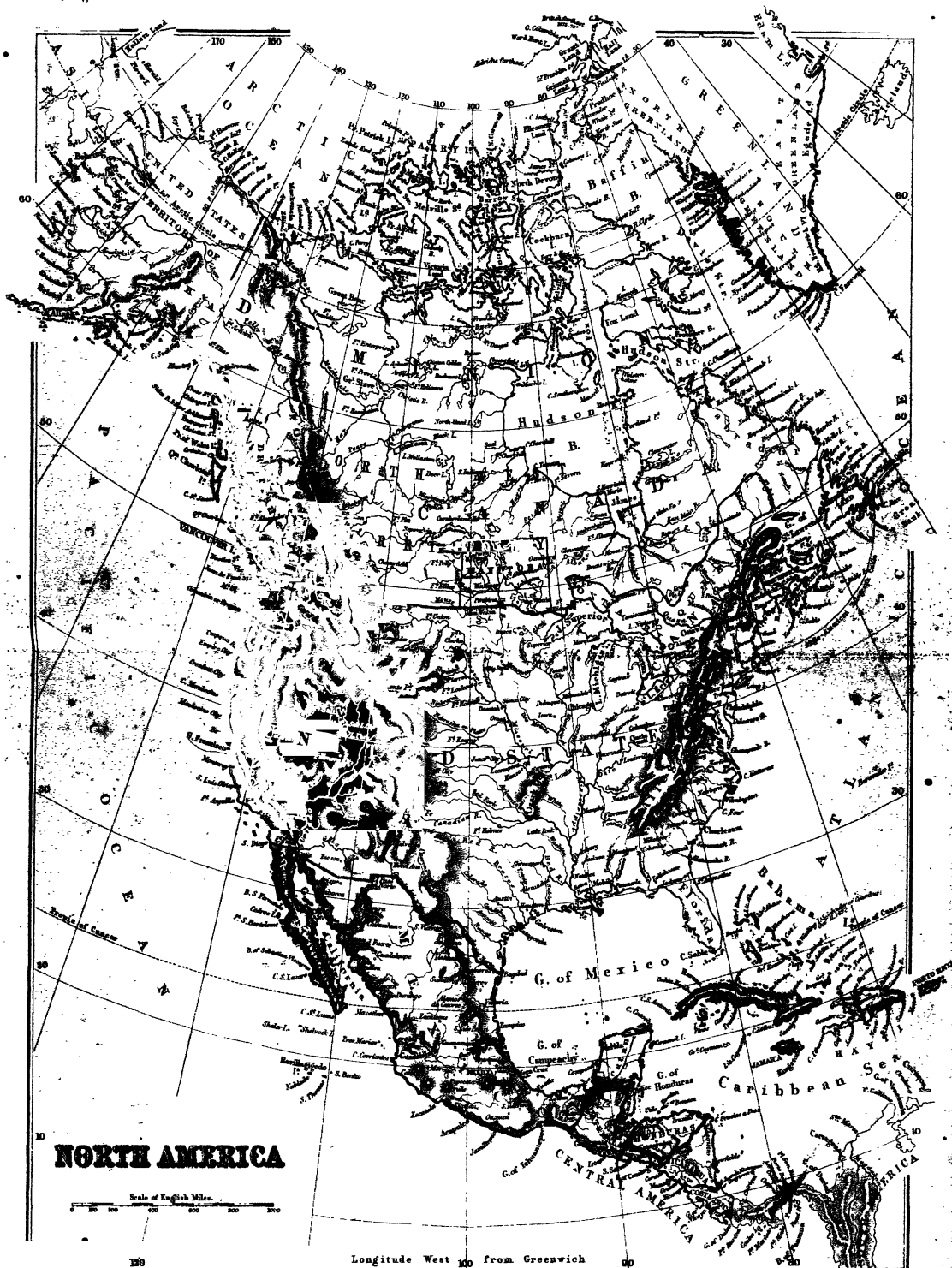
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NORTH AMERICA

Scale of English Miles.
0 50 100 150 200 250 300

Longitude West 100 from Greenwich

1

1

N O S E



4. Bony Septum.



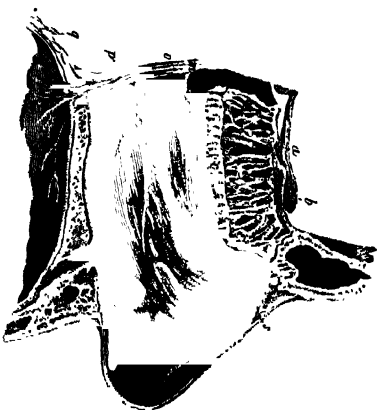
1-2 Fibro cartilages of Nose



3. Muscles of the Nose



5. Turbinate Bones.



Olfactory Nerve.



6. Section through the nasal cavity.



8. Muscles and Ordinary Nerves of the Nose.

NUMERALS.

PLATE I.

PALMYRENE NUMERALS.

D	ΔΔ	XL ΔΔ	XXI ΔΔ	XI ΔΔ	I ΔΔ
DC	Δ/Δ	L ΔΔΔ	XXII ΔΔ	XII ΔΔ	II ΔΔ
DCC	Δ//Δ	LX ΔΔΔ	XXIII ΔΔ	XIII ΔΔ	III ΔΔ
DCCC	Δ///Δ	LXX ΔΔΔ	XXIV ΔΔΔ	XIV ΔΔΔ	IV ΔΔ
DCCCC	Δ////Δ	LXXX ΔΔΔ	XXV ΔΔ	XV ΔΔ	V ΔΔ
DCCCCX	Δ/////Δ	XC ΔΔΔΔ	XXVI ΔΔ	XVI ΔΔ	VI ΔΔ
DCCCCXL	Δ////Δ	C Δ/	XXVII ΔΔ	XVII ΔΔ	VII ΔΔ
DCCCCX	Δ////Δ	CC Δ//	XXVIII ΔΔ	XVIII ΔΔ	VIII ΔΔ
DCCCCXXX	Δ////Δ	CCC Δ///	XXIX ΔΔ	XIX ΔΔ	IX ΔΔ
M	ΔΔ/	CCCC Δ////	XXX ΔΔ	XX ΔΔ	X ΔΔ

ROMAN NUMERALS.

I	I	(2)	II	(3)	III	(4)	IV
5			V	6			VI
9			IX	10			X
50			L	90			XC
100			C	200			CC
500			D				
1000			M				
5000							
10000							
50000							
100000							
500000							

ANCIENT GREEK NUMERALS (INSCRIPTIONS)

1	I	6	ΠI	16	ΔΠI	60	ΔΔ
2	II	7	ΠII	20	ΔΔ	75	ΔΔΠ
3	III	10	Δ	25	ΠΠ	100	H
4	IIII	11	ΔI	30	ΔΔΔ	200	HH
5	Π	15	ΔΠ	50	ΔΠ	500	HH

PHENICIAN NUMERALS.

I	/	XL	I I
II	//	L	- 4 4
III	///	LX	1 4 4
IV	////	LXX	- 1 4 4
V	/////	LXXX	4 4 4 4
VI	//////	XC	- 1 4 4 4
VII	////////		
VIII	////////		
IX	////////		
X	ρ - ρ -		
XI	/ -		
XII	// -		
XIII	/// -		
XIV	//// -		
XV	///// -		
XVI	////// -		
XVII	//////// -		
XVIII	//////// -		
XIX	//////// -		
XX	N N N N		
XXI	1 A		
XXII	1 1 N		
XXIII	1 1 1		
XXIV	1 1 1 1		
XXV	1 1 1 1 1		
XXX	- N		

NUMERALS.

PLATE 2.

Hieroglyphic				Hieratic				Demotic			
1	1.	30	nnn. 3	1	1.7.3.4.	100	1	1.2.	2	1.2.	
2	11.	40	nnnn.	2	4.2.	200	2	4.	2	4.	
3	111.	50	nnnnn.	3	3.2.14.	300	3	3.6.1.	3	3.6.1.	
4	1111. 4	60	nnnnnn.	4	4.2.14.	400	4	4.2.14.	4	4.2.14.	
5	11111.	70	nnnnnnn.	5	5.7.7.	500	5	5.7.7.	5	5.7.7.	
6	111111.	80	nnnnnnnn.	6	6.8.6.	600	6	6.8.6.	6	6.8.6.	
7	1111111. 7	90	nnnnnnnnn.	7	7.7.7.	700	7	7.7.7.	7	7.7.7.	
8	11111111. 8	100	nnnnnnnnnn.	8	8.8.8.	800	8	8.8.8.	8	8.8.8.	
9	111111111. 9	110	nnnnnnnnnnn.	9	9.9.9.	900	9	9.9.9.	9	9.9.9.	
10	1111111111. 10	120	nnnnnnnnnnnn.	10	10.10.10.	1000	10	10.10.10.	10	10.10.10.	
11	11111111111. 11	130	nnnnnnnnnnnnn.	11	11.11.11.	1100	11	11.11.11.	11	11.11.11.	
12	111111111111. 12	140	nnnnnnnnnnnnnn.	12	12.12.12.	1200	12	12.12.12.	12	12.12.12.	
13	1111111111111. 13	150	nnnnnnnnnnnnnnn.	13	13.13.13.	1300	13	13.13.13.	13	13.13.13.	
14	11111111111111. 14	160	nnnnnnnnnnnnnnnn.	14	14.14.14.	1400	14	14.14.14.	14	14.14.14.	
15	111111111111111. 15	170	nnnnnnnnnnnnnnnnn.	15	15.15.15.	1500	15	15.15.15.	15	15.15.15.	
16	1111111111111111. 16	180	nnnnnnnnnnnnnnnnnn.	16	16.16.16.	1600	16	16.16.16.	16	16.16.16.	
17	11111111111111111. 17	190	nnnnnnnnnnnnnnnnnnn.	17	17.17.17.	1700	17	17.17.17.	17	17.17.17.	
18	111111111111111111. 18	200	nnnnnnnnnnnnnnnnnnnn.	18	18.18.18.	1800	18	18.18.18.	18	18.18.18.	
19	1111111111111111111. 19	210	nnnnnnnnnnnnnnnnnnnnn.	19	19.19.19.	1900	19	19.19.19.	19	19.19.19.	
20	11111111111111111111. 20	220	nnnnnnnnnnnnnnnnnnnnnn.	20	20.20.20.	2000	20	20.20.20.	20	20.20.20.	
21	111111111111111111111. 21	230	nnnnnnnnnnnnnnnnnnnnnnn.	21	21.21.21.	2100	21	21.21.21.	21	21.21.21.	
22	1111111111111111111111. 22	240	nnnnnnnnnnnnnnnnnnnnnnnn.	22	22.22.22.	2200	22	22.22.22.	22	22.22.22.	

Hieroglyphic				Hieratic				Demotic			
1	1.	1	1.	1	1.	1	1.	1	1.	1	1.
2	2.	2	2.	2	2.	2	2.	2	2.	2	2.
3	3.	3	3.	3	3.	3	3.	3	3.	3	3.
4	4.	4	4.	4	4.	4	4.	4	4.	4	4.
5	5.	5	5.	5	5.	5	5.	5	5.	5	5.
6	6.	6	6.	6	6.	6	6.	6	6.	6	6.
7	7.	7	7.	7	7.	7	7.	7	7.	7	7.
8	8.	8	8.	8	8.	8	8.	8	8.	8	8.
9	9.	9	9.	9	9.	9	9.	9	9.	9	9.
10	10.	10	10.	10	10.	10	10.	10	10.	10	10.
11	11.	11	11.	11	11.	11	11.	11	11.	11	11.
12	12.	12	12.	12	12.	12	12.	12	12.	12	12.
13	13.	13	13.	13	13.	13	13.	13	13.	13	13.
14	14.	14	14.	14	14.	14	14.	14	14.	14	14.
15	15.	15	15.	15	15.	15	15.	15	15.	15	15.
16	16.	16	16.	16	16.	16	16.	16	16.	16	16.
17	17.	17	17.	17	17.	17	17.	17	17.	17	17.
18	18.	18	18.	18	18.	18	18.	18	18.	18	18.
19	19.	19	19.	19	19.	19	19.	19	19.	19	19.
20	20.	20	20.	20	20.	20	20.	20	20.	20	20.
21	21.	21	21.	21	21.	21	21.	21	21.	21	21.
22	22.	22	22.	22	22.	22	22.	22	22.	22	22.
23	23.	23	23.	23	23.	23	23.	23	23.	23	23.
24	24.	24	24.	24	24.	24	24.	24	24.	24	24.

NUMERALS.

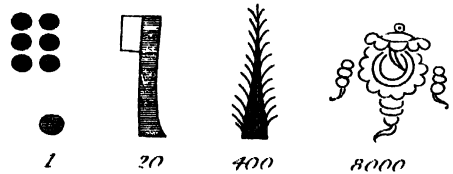
PLATE 3.

CHINESE NUMERALS.

Series 1 st	Series 2 nd	Series 3 rd	
yāy • 一	壹	一	one
ēr • 二	貳	二	two
sān • 三	叁	三	three
sì • 四	肆	四	four
wū • 五	伍	五	five
liù • 六	陸	六	six
qī • 七	柒	七	seven
bā • 八	捌	八	eight
jiǔ • 九	玖	九	nine
shí • 十	拾	十	ten
yāy • 一	壹	百	100
pǎi • 百	佰	百	
yāy • 一	壹	千	1000
wàn • 一	萬	萬	10,000
shí • 十	拾	萬	100,000
wàn • 萬	萬	萬	1,000,000
yāy • 一	億	億	100,000,000
qī • 七	百	萬	700,000,000
wàn • 萬	萬	萬	1,000,000,000
hào • 兆	兆	兆	1,000,000,000,000

yāy • 一	一	壹		
wàn • 一	千	仟		
lǐng • 零	零	零	10—	1000
yāy • 一	一	壹		
yāy • 一	一	壹		
ēr • 二	二	貳		
shí • 十	十	拾	11=	22
ēr • 二	二	貳	+	

MEXICAN NUMERAL HIEROGLYPHICS.



ORIGIN OF ARABIC CIPHERS.

European forms		Gobar forms	Indian forms		Letters of the Indo-Bactrian Alphabet
14 th Cent.	12 th Cent.	10 th Cent.	10 th Cent.	5 th Cent.	2 nd Century B.C.
1	1	1	1	1	one stroke
2	2	2	2	2	two strokes
3	3	3	3	3	three strokes
4	4	4	4	4	4 - chh
5	5	5	5	5	5 - p
6	6	6	6	6	6 - s
7	7	7	7	7	7 - sh
8	8	8	8	8	8 - a
9	9	9	9	9	9 - n

ORANGE.
SEVILLE ORANGE



ORCHIDÆ.



Oncidium lanceanum

ORDERS OF MERIT.

Page 7

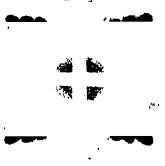
ENGLISH



Garter



Jewel



Star

GARTER



Jewel 1st Class



Star 2nd Class

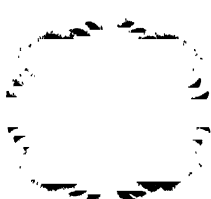


Star 3rd Class

BATH



Jewel



Star

THISTLE



VICTORIA CROSS



Jewel



Star

ST. PATRICK

FRENCH



1st Class



2nd Class



3rd Class

CROSS OF THE LEGION OF HONOUR



PUBLIC INSTRUCTION



ACADÉMIE
FRANÇAISE

PRUSSIAN



Jewel



Star

BLACK EAGLE



Jewel

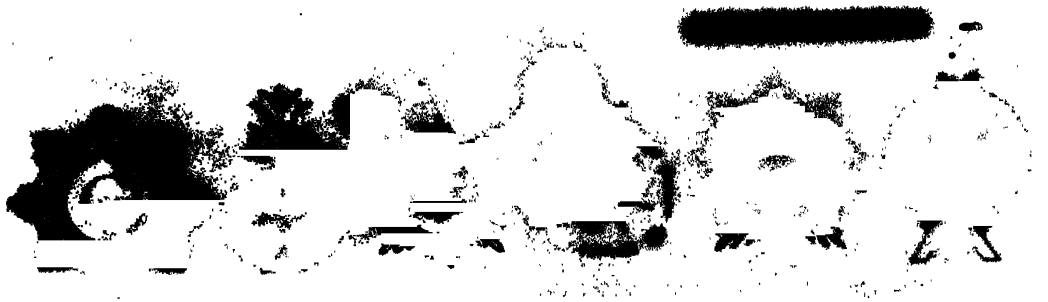


Star

RED EAGLE



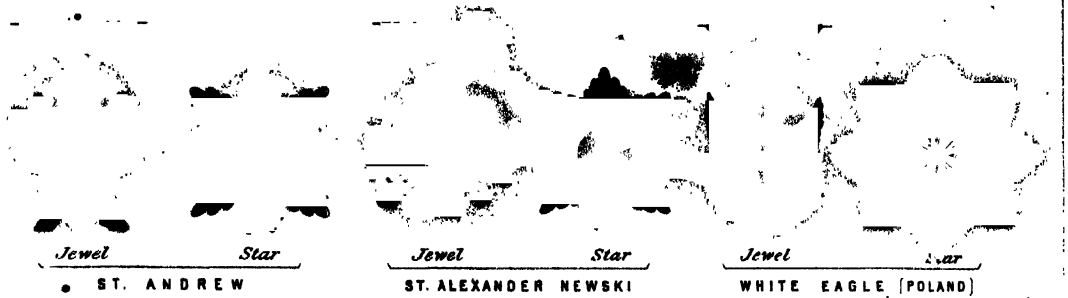
IRON CROSS



DEERS OF MERIT:

PLATE 2.

R U S S I A N



Jewel Star

ST. ANDREW

Jewel Star

ST. ALEXANDER NEWSKI

Jewel Star

WHITE EAGLE (POLAND)

A U S T R I A N



GOLDEN FLEECE

MARIA THERESA

ST. STEPHEN

IRON CROWN

B A D E N

B A V A R I A N

T U R K I S H



Jewel Star

FIDELITÉ

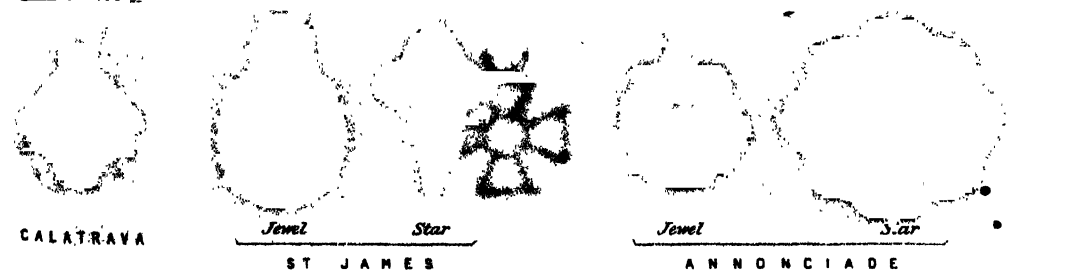
Jewel Star

ST. HUBERT

MEDJIDIE

S P A N I S H

I T A L I A N



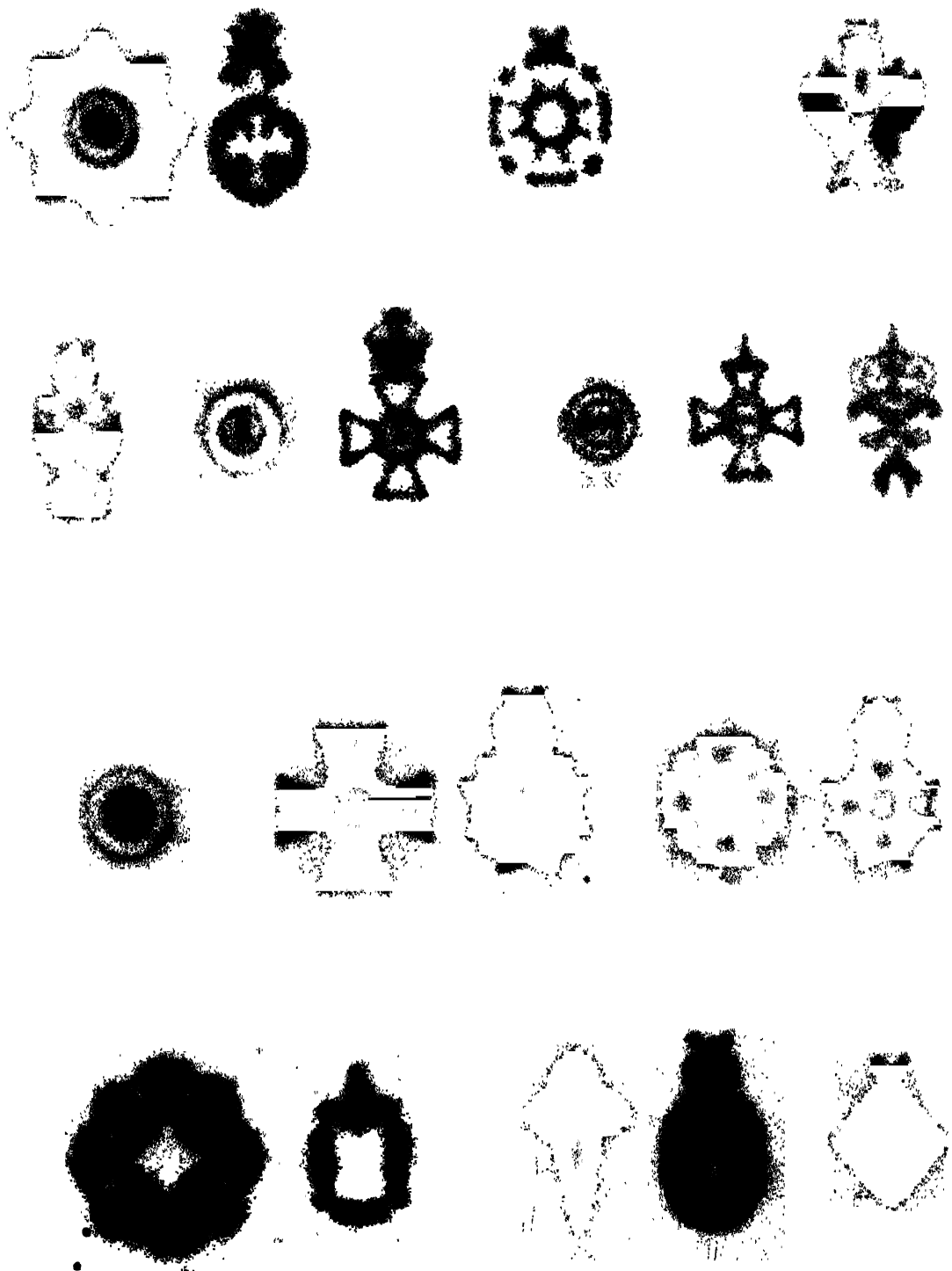
CALATRAVA

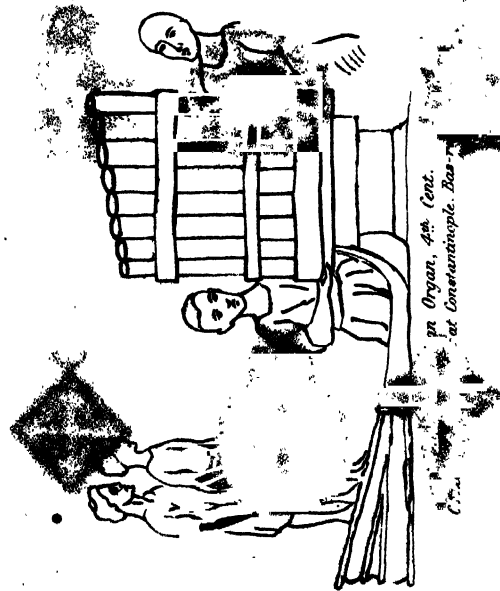
Jewel Star

ST JAMES

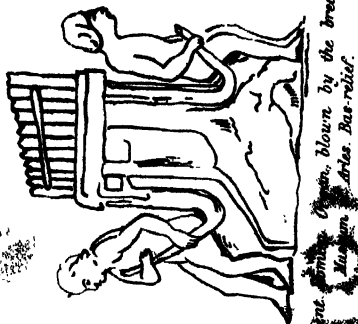
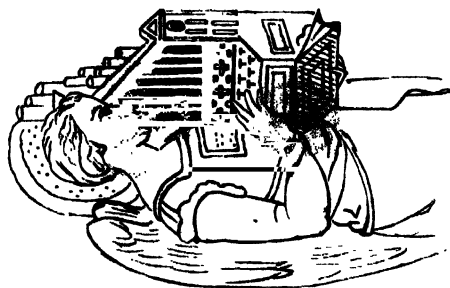
Jewel Star

ANNONCIATE

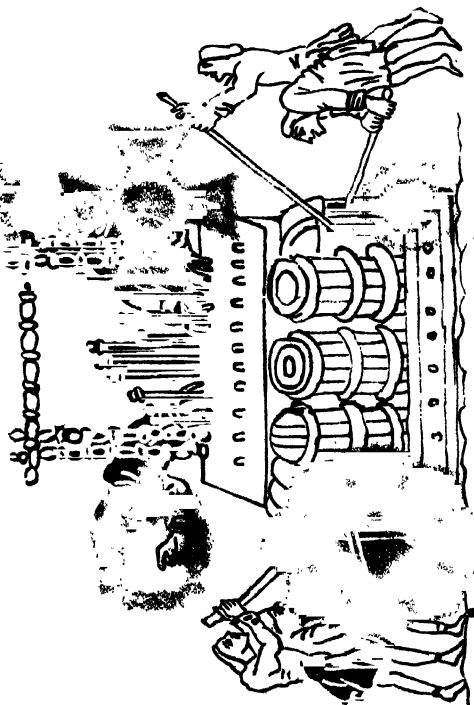




an Organ, 4th Cent.
at Constantinople. Bas-relief.



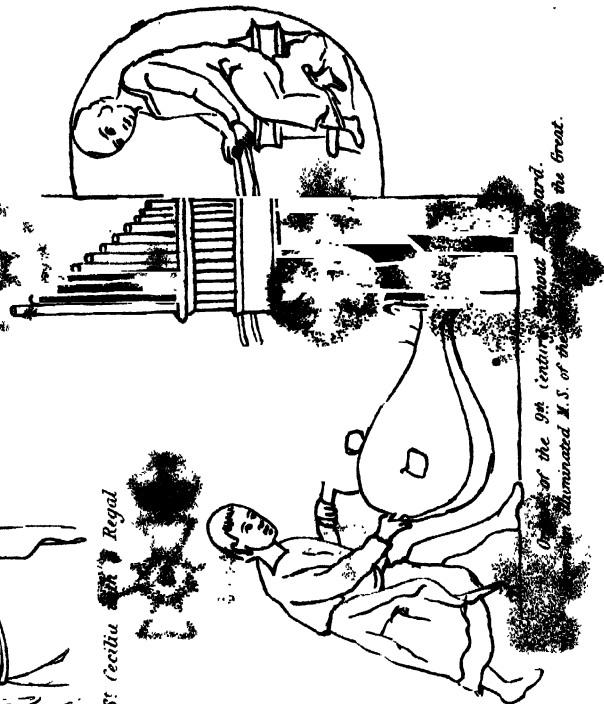
Organ, blown by the breath
of man. Bas-relief.



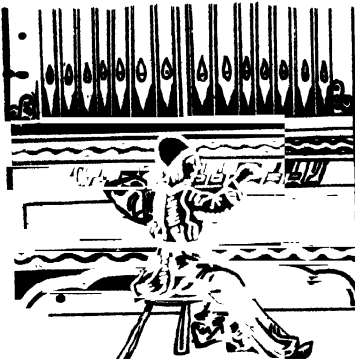
Ancient English Organ, 10th Cent.

From an illumination, Bodleian Palace, Trin. Coll. Cambridge.

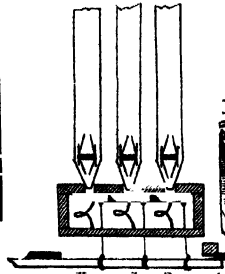
St. Cecilia Regal



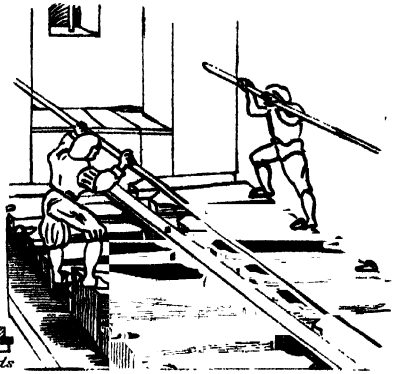
Organ of the 9th century without keyboard.
Illuminated M.S. of the Great.



Broad-keyed organ, 16th century.
From Gaffurius "Theoria Musica" Milan, 1492.



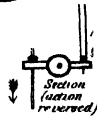
Key and pulled cords
16th century
Wind chest.



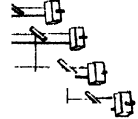
Organ with 20 bellows,
St. Agilian Brunswick, 15th cent.



Principal Key-board
of the Hülshorst Organ (1861)

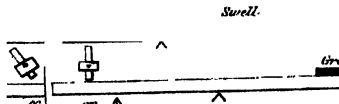


Man Action continued

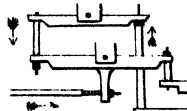


Roller Board

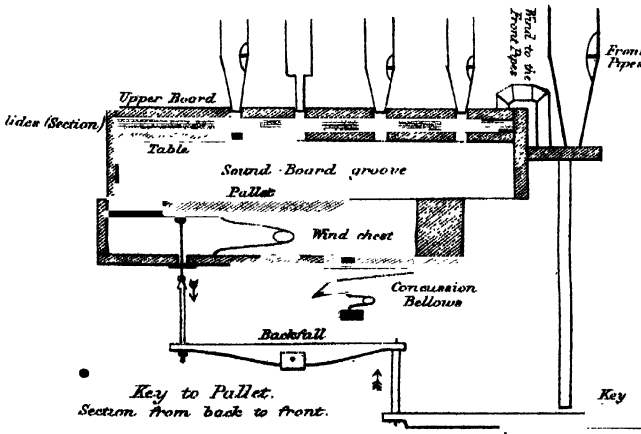
Re function.



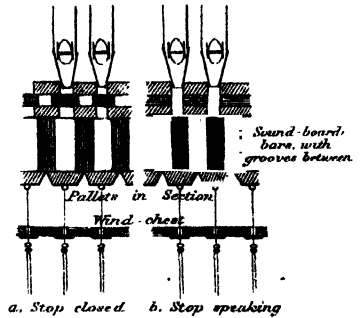
Old "Tumbler" Coupler, Swell to Great.



Modern Coupler, Swell to Great.

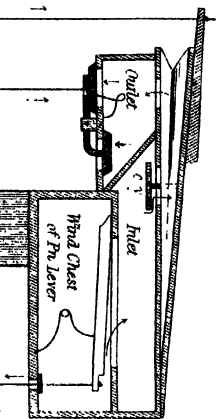
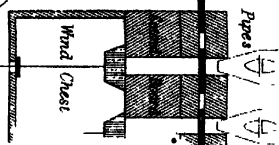
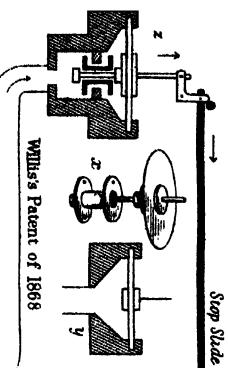


Key to Pallet.
Section from back to front.



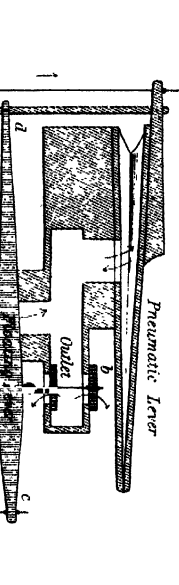
Section across
Wind chest

PNEUMATIC AND ELECTRIC ACTIONS.

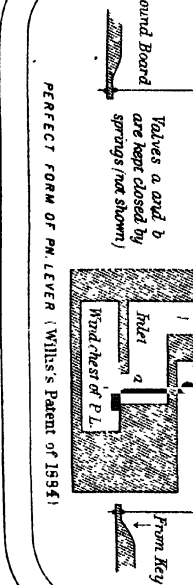


Sound Board Backfall

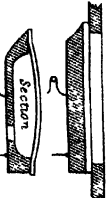
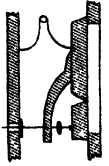
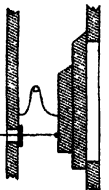
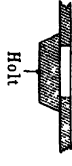
ORDINARY PNEUMATIC LEVER WITH CONNECTIONS



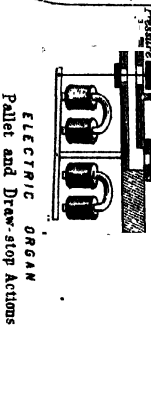
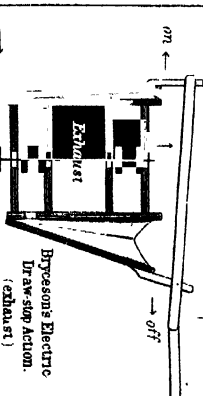
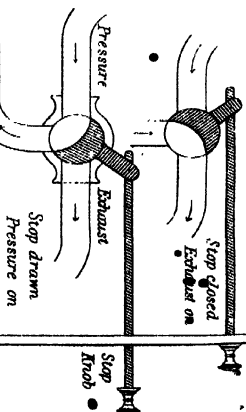
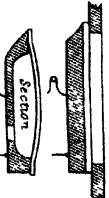
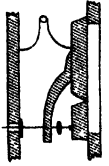
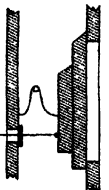
PERFECT FORM OF PN LEVER (Willis's Patent of 1894)



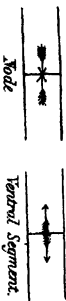
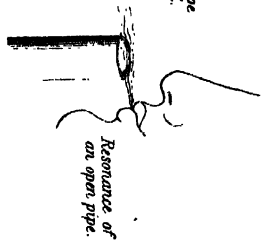
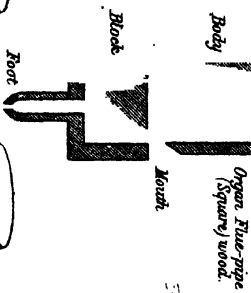
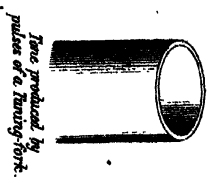
SOUND-BOARD PALETS.



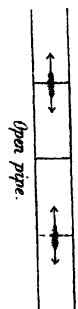
ELECTRIC ORGAN Making and Breaking circuit, Key action



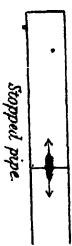
ORGAN-PIPES.



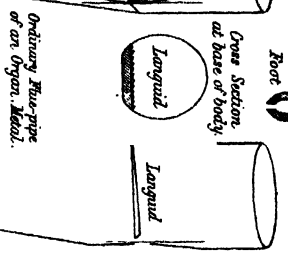
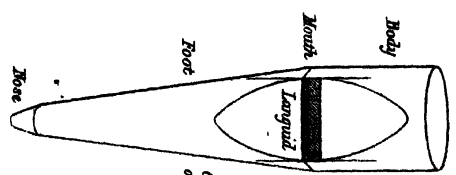
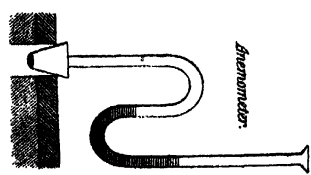
Sound pulses in Organ pipes.



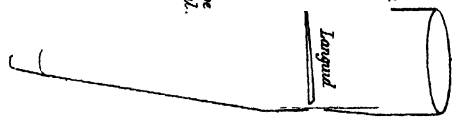
Open pipe.



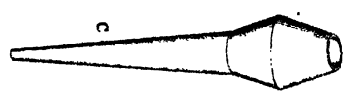
Stopped pipe.



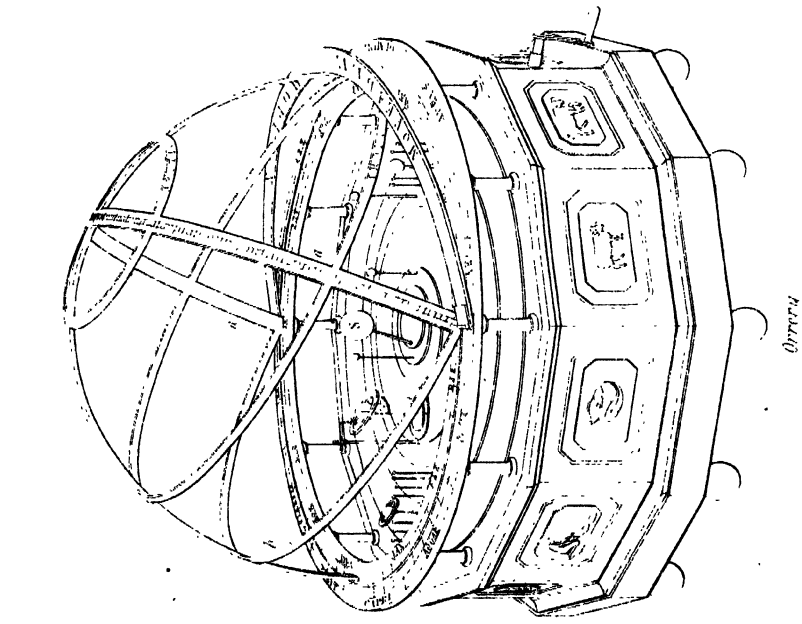
Ordinary Flute-pipe of an Organ. Metal.



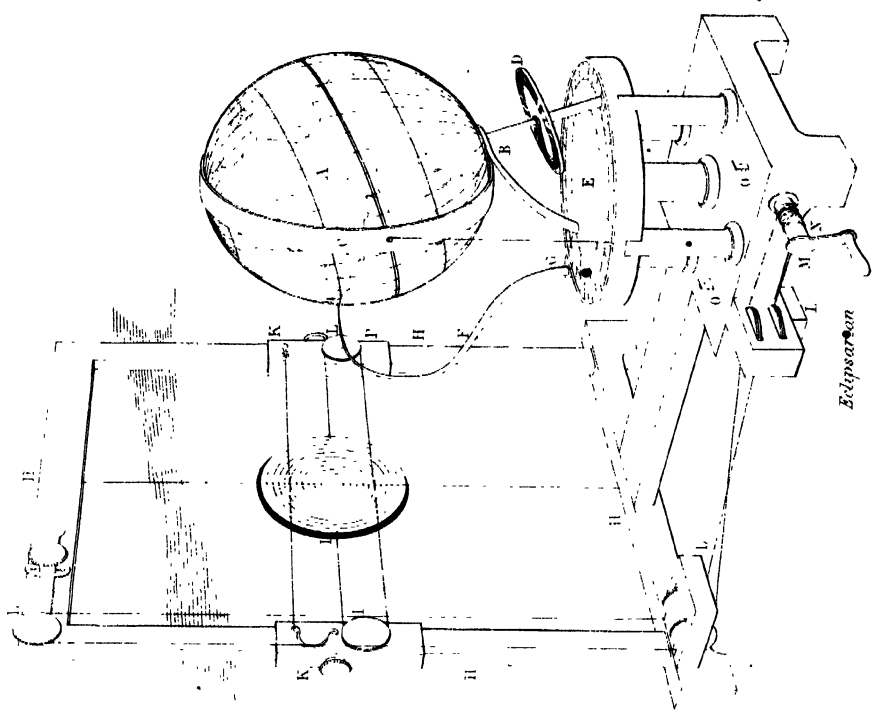
Reed pipe of an Organ.



Forms of pipes.



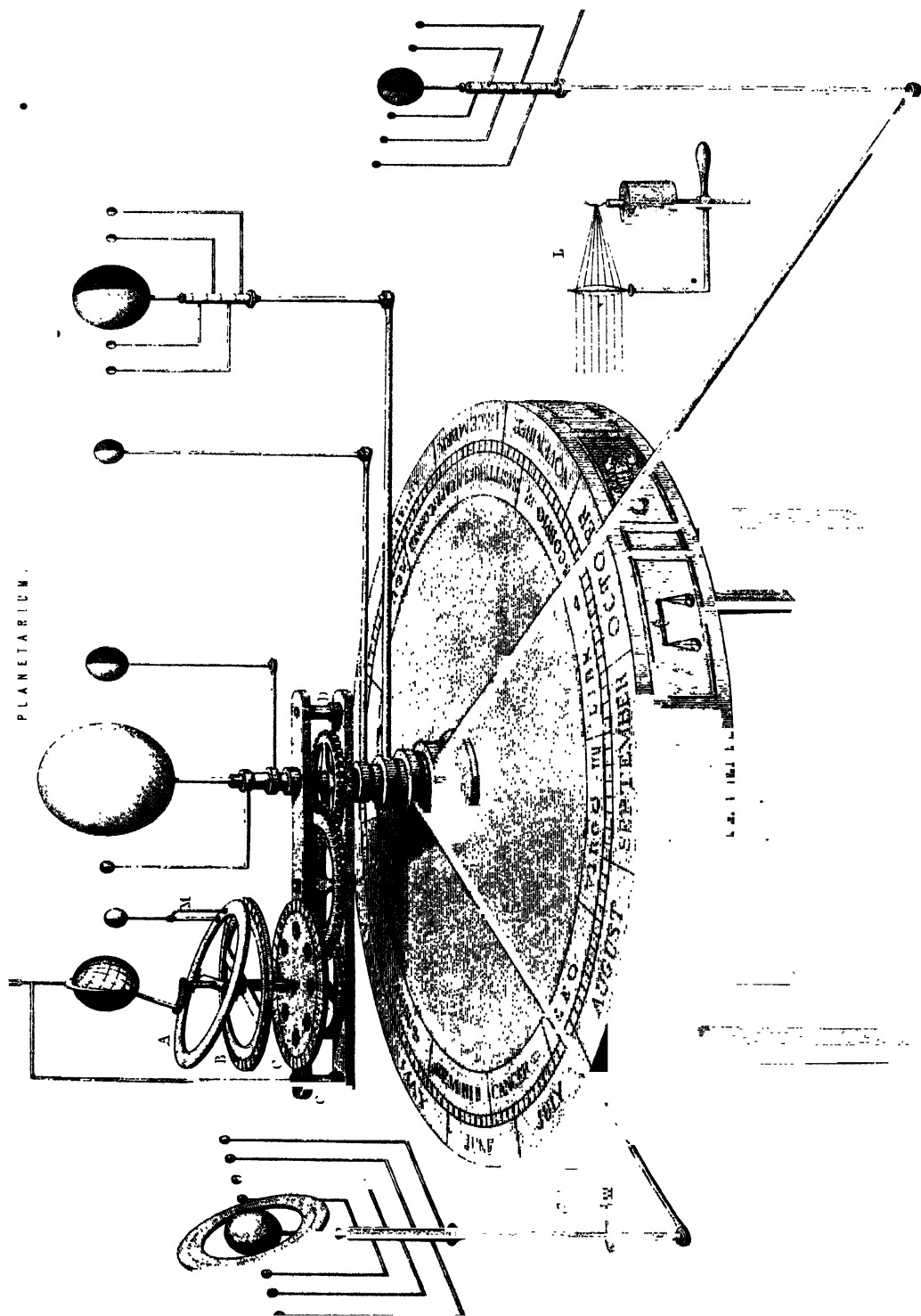
Observer



Eclipsegraph

ORRERY. PLANETARIUM.

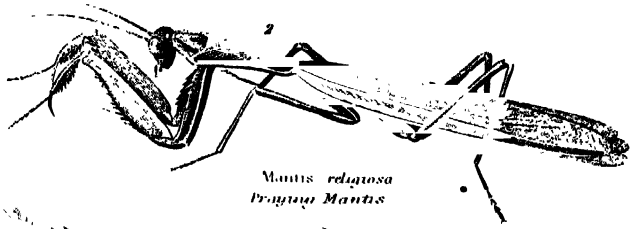
PLATE 2.



ORTHOPTERA



Blatta lapponica
Lapland Cockroach



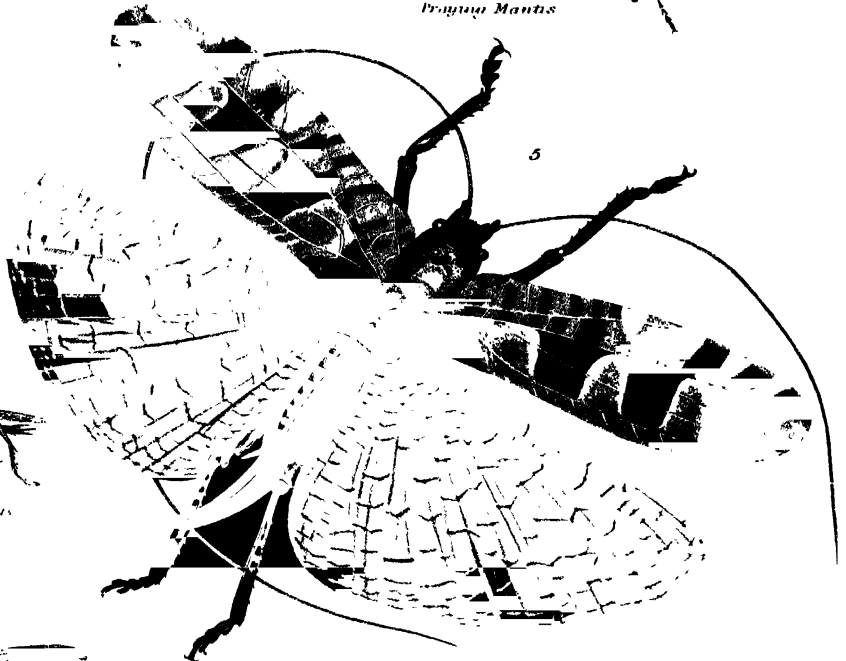
Mantis religiosa
Praying Mantis



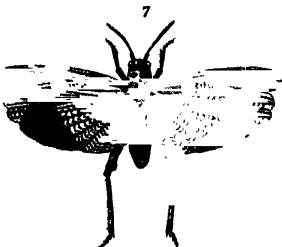
Forficula auricularia
Earwig



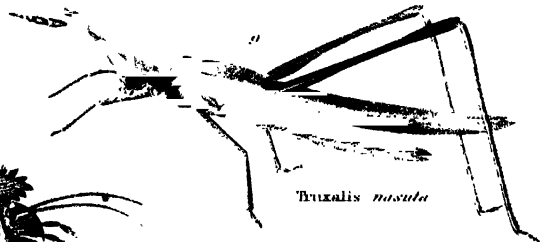
Tubactelus pusillicornis



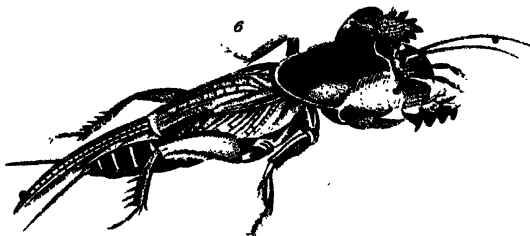
Acanthodis imperialis . The Emperor black and green Cricket



Acrydium amileus
Blue winged Grasshopper



Tytialis nasuta



Gryllotalpa vulgaris
Mole-cricket



Acrydium bipunctatum



Strix stridula. Tawny Owl.

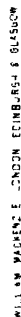


Nyctea scandiaca. Snowy Owl.



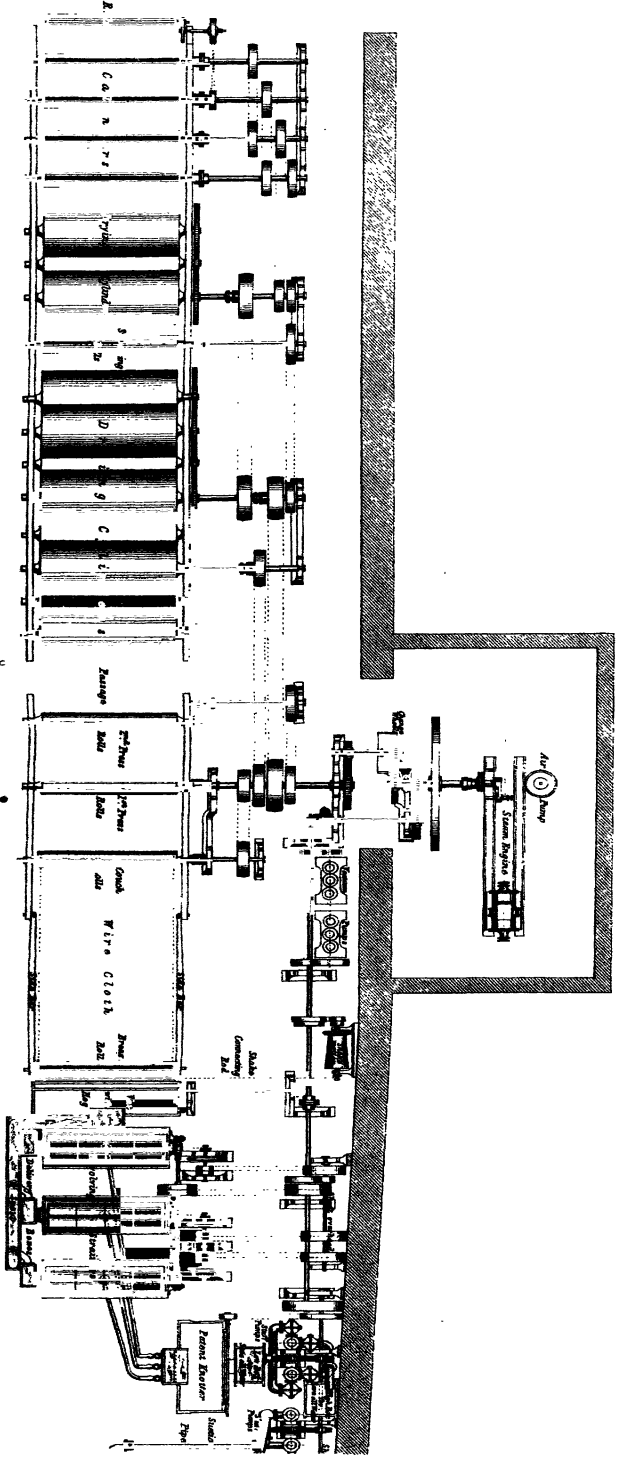
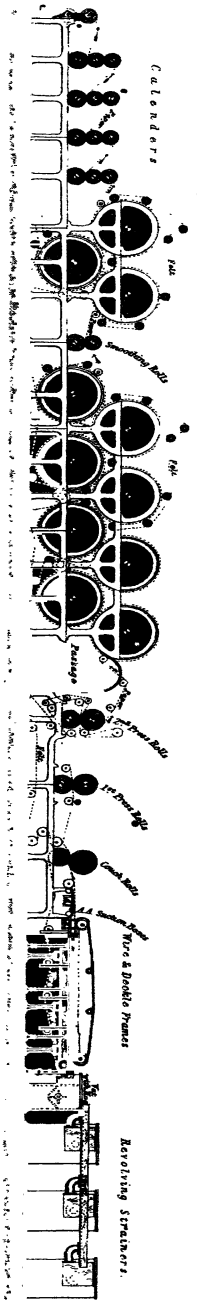
Aluco thurmeus. Barn Owl.

PLAN OF THE CANAL



Drying Cylinders

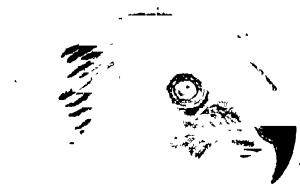
Drying Cylinders



P A R R O T .



Macrocerus macro *Scarlet Macaw.*



Microglossus aterrimus.
Grey Small-tongued Parrot.



Psittacus erythacus. *Grey Parrot.*



Psittacula pileata. *Bonneted Psittacule.*

PASSERES.

TENUIROSTRES.

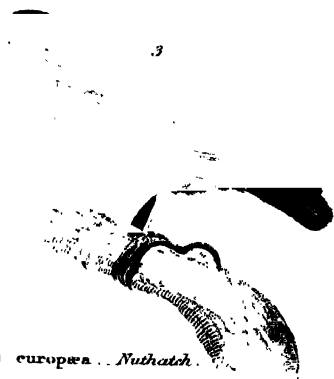
PLATE I.



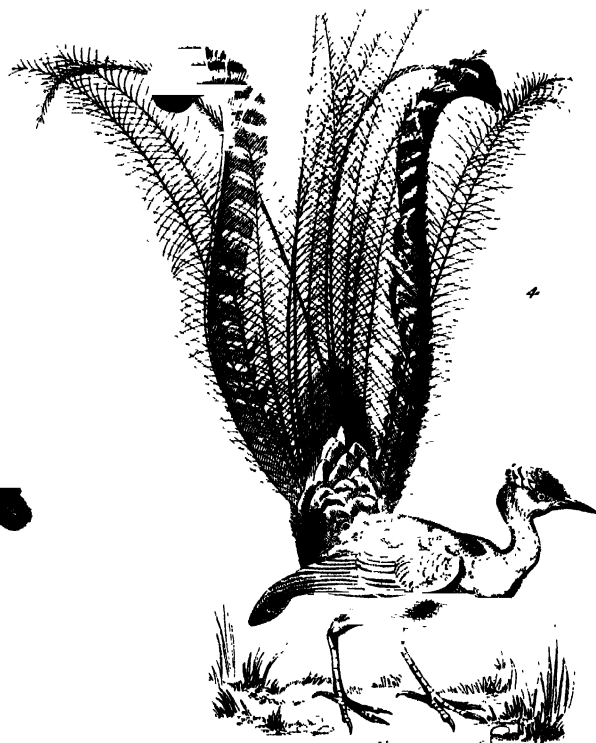
Certhia familiaris—*Creeping*.



Tichodroma muraria—*Wall Creeper*.



Sitta europaea—*Nuthatch*.

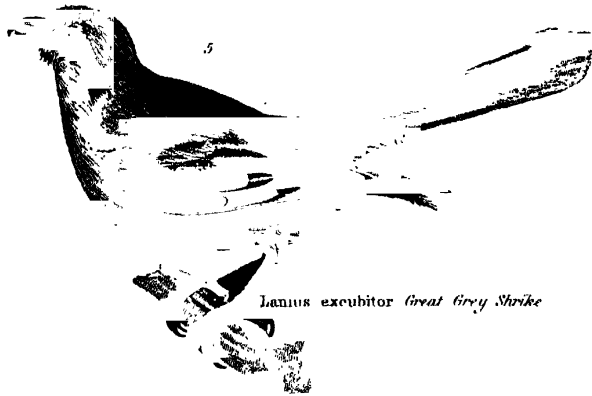


Menura superba—*Lyre bird*.

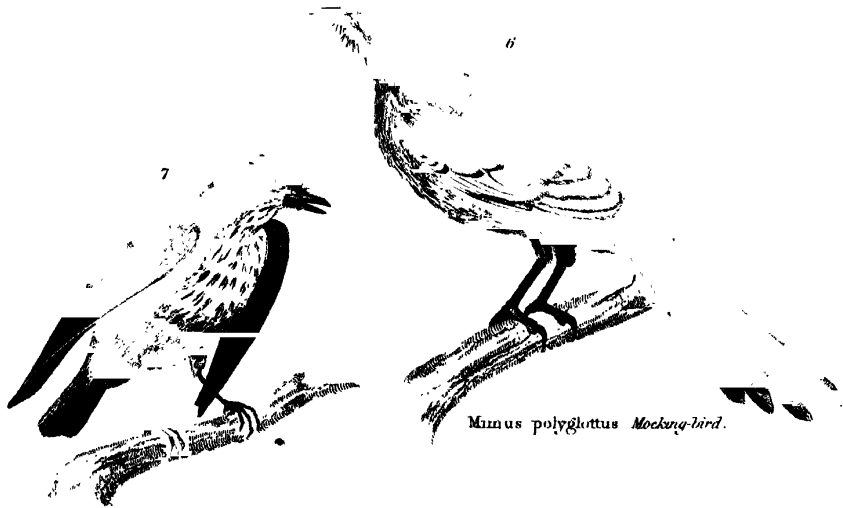
PASSERES.

DENTIROSTRES

PLATE 2.



Lanius excubitor Great Grey Shrike



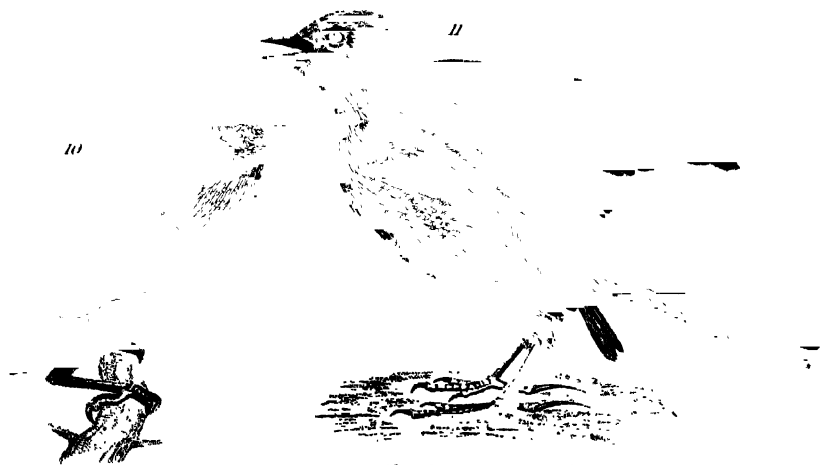
Mimus polyglottus Mocking-bird.

Muscicapa griseola Spotted Flycatcher.



Tanager vittata Banded Tanager.

Loxia curvirostra Crossbill



Alauda arvensis Skylark.

Emberiza hortulana Ortolan



Paradisæ apoda Emerald Paradise Bird.

Magpie.

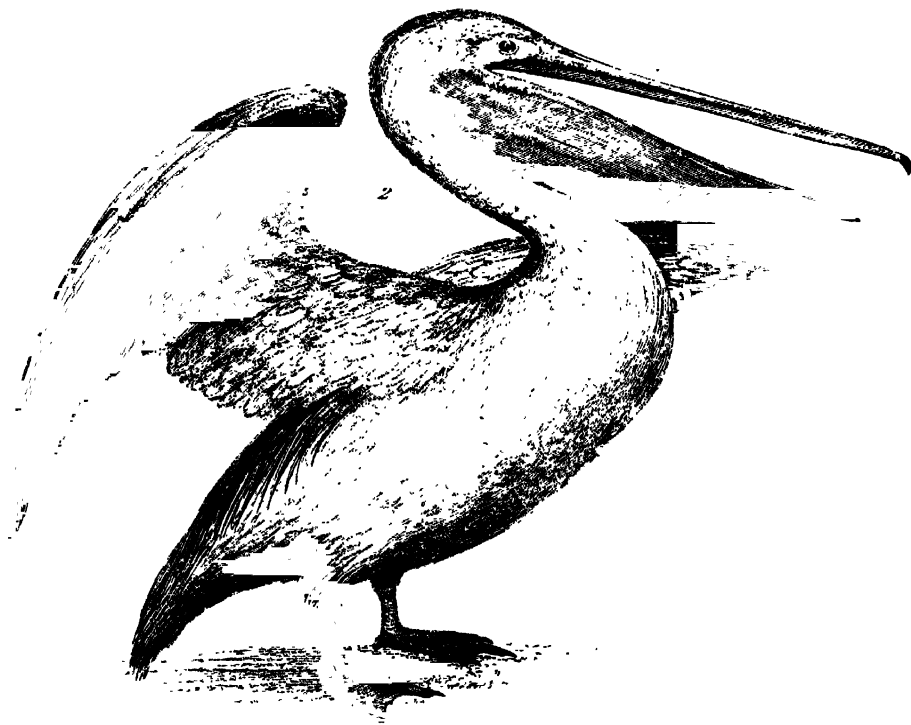
Sturnus vulgaris Starb

PELECANI

PLATE I.



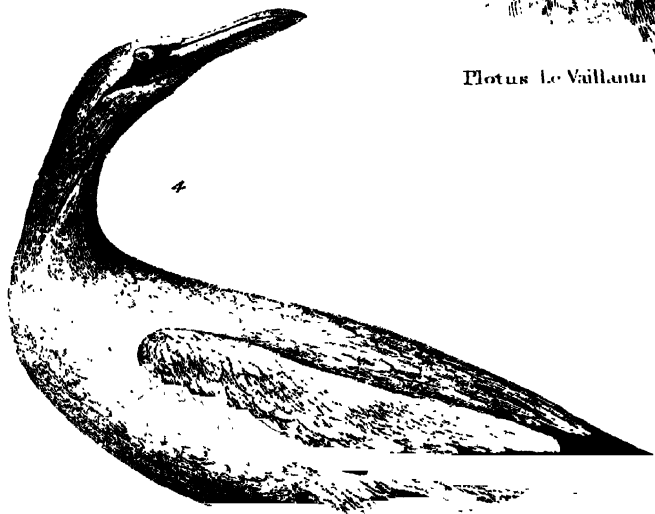
Phalacrocorax carbo Common Loon



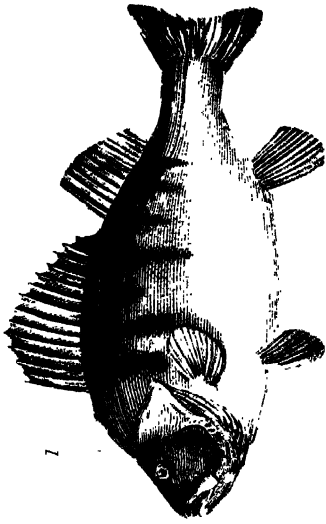
Pelecanus onocrotalus. Common Pelican.



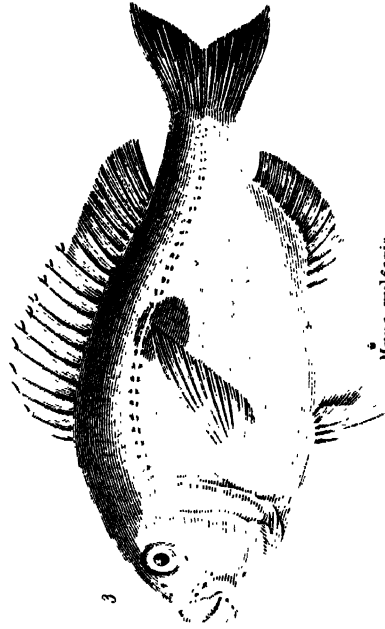
Flotus Le Vaillant Le Vaillants Doctor.



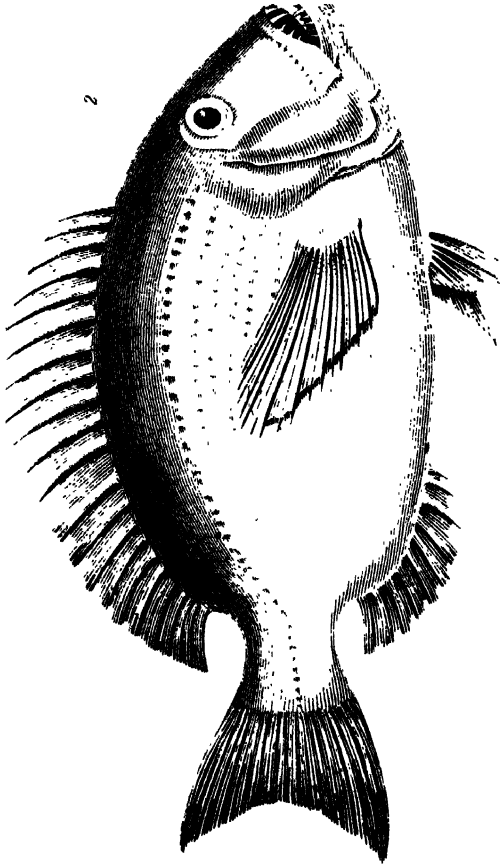
Sula alba...White Gannet.



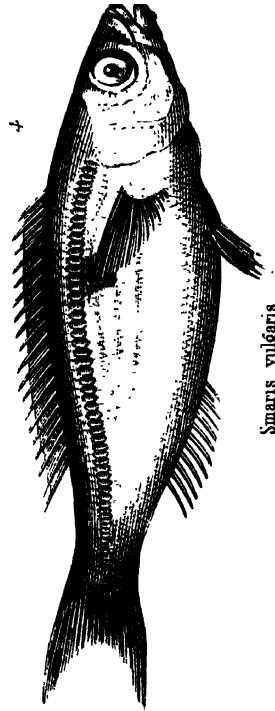
Perca fluvi



Mena vulgaris

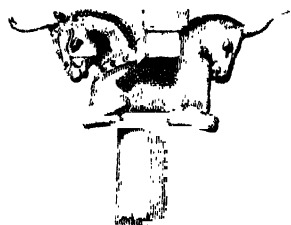


Dentex vulgaris

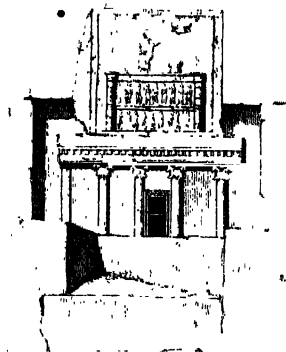


Smaris vulgaris

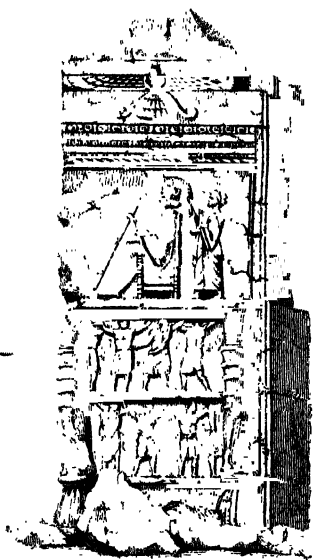
PERSIAN ARCHITECTURE AND PYRAMIDS.



*Capital of a Column
at Persepolis*



*Facade of Rock-cut Tomb
of Darius at Persepolis*



A Pier at Persepolis



*Egyptian reed-column with
lotus bud capital Beni Hassan.*



A column at Persepolis restored

PYRAMIDS.



*Arched Gallery in the
Great Pyramid.*



*Roof of Kings Chamber
in the Great Pyramid.*



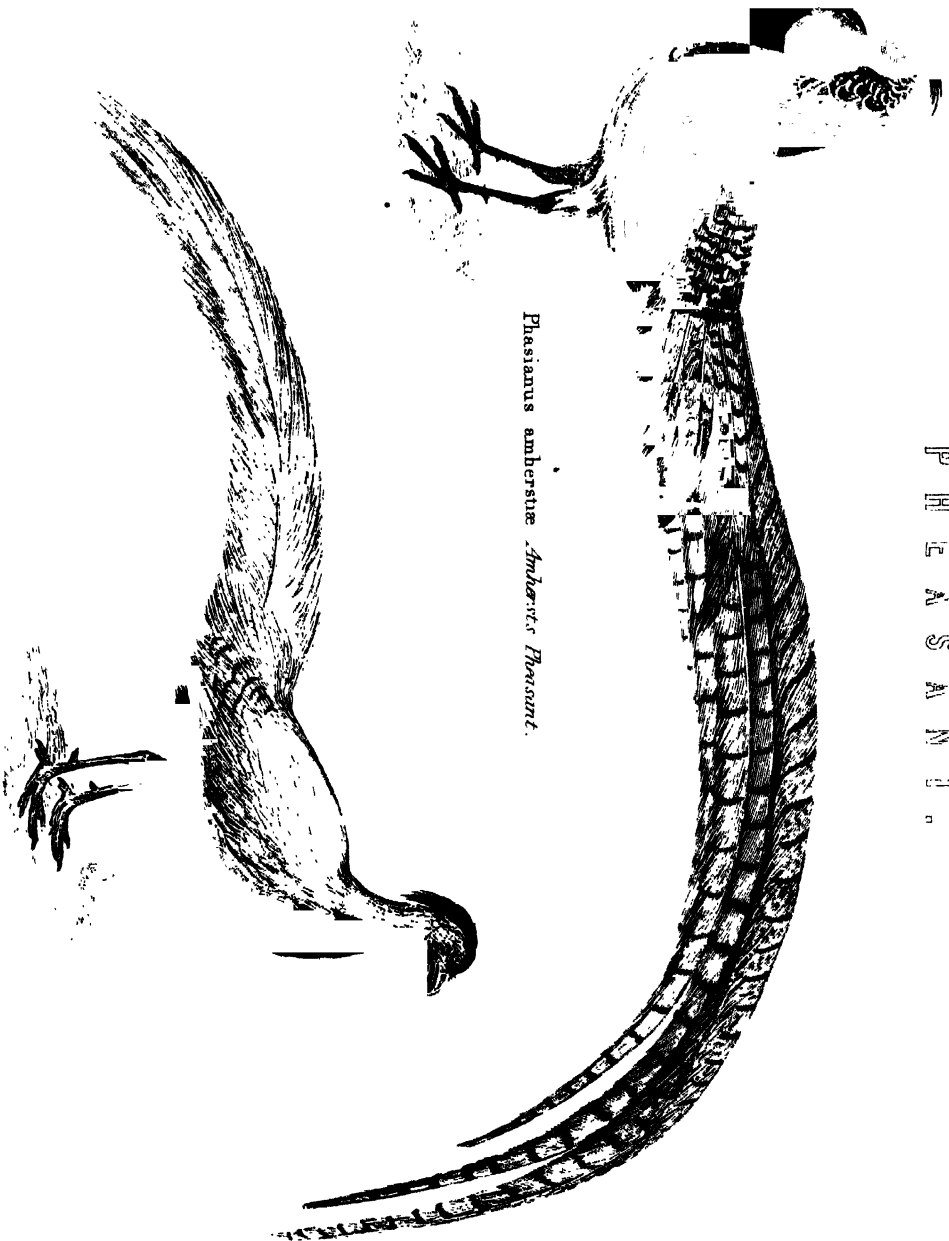
*Section of the ascending Gallery
in the Great Pyramid.*



*The Sepulchral Chamber in the
Pyramid of Chephren at Gizeh.*

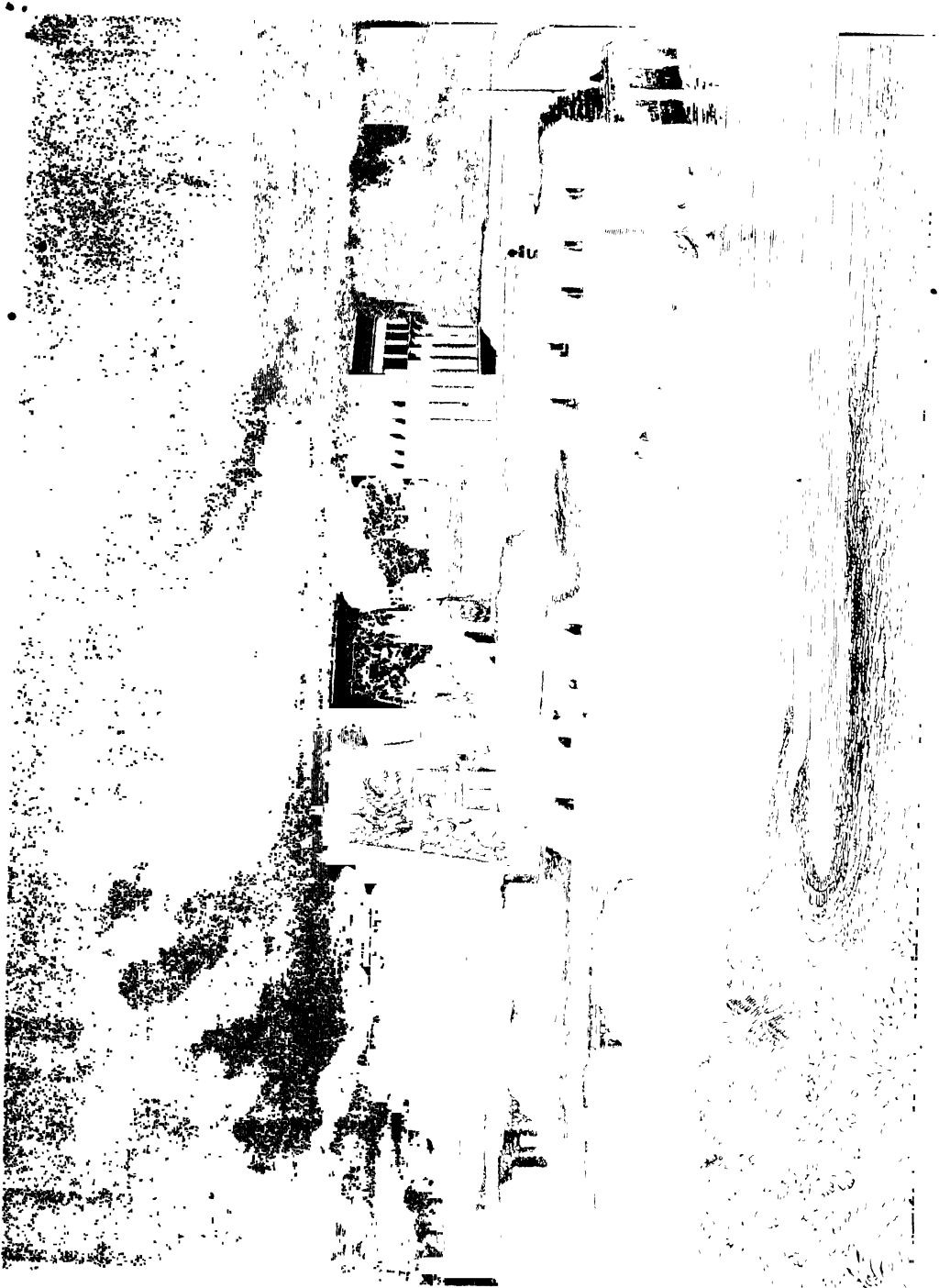
Interior Structure of the Pyramids.

PHASIANI.



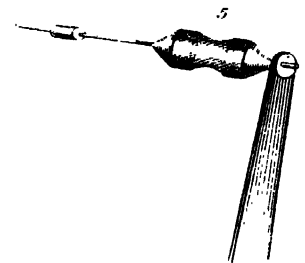
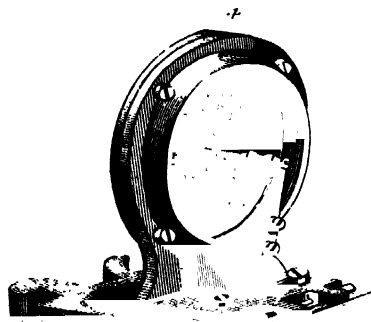
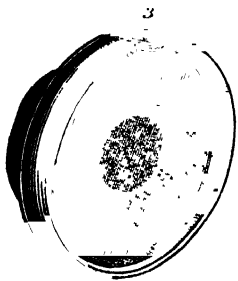
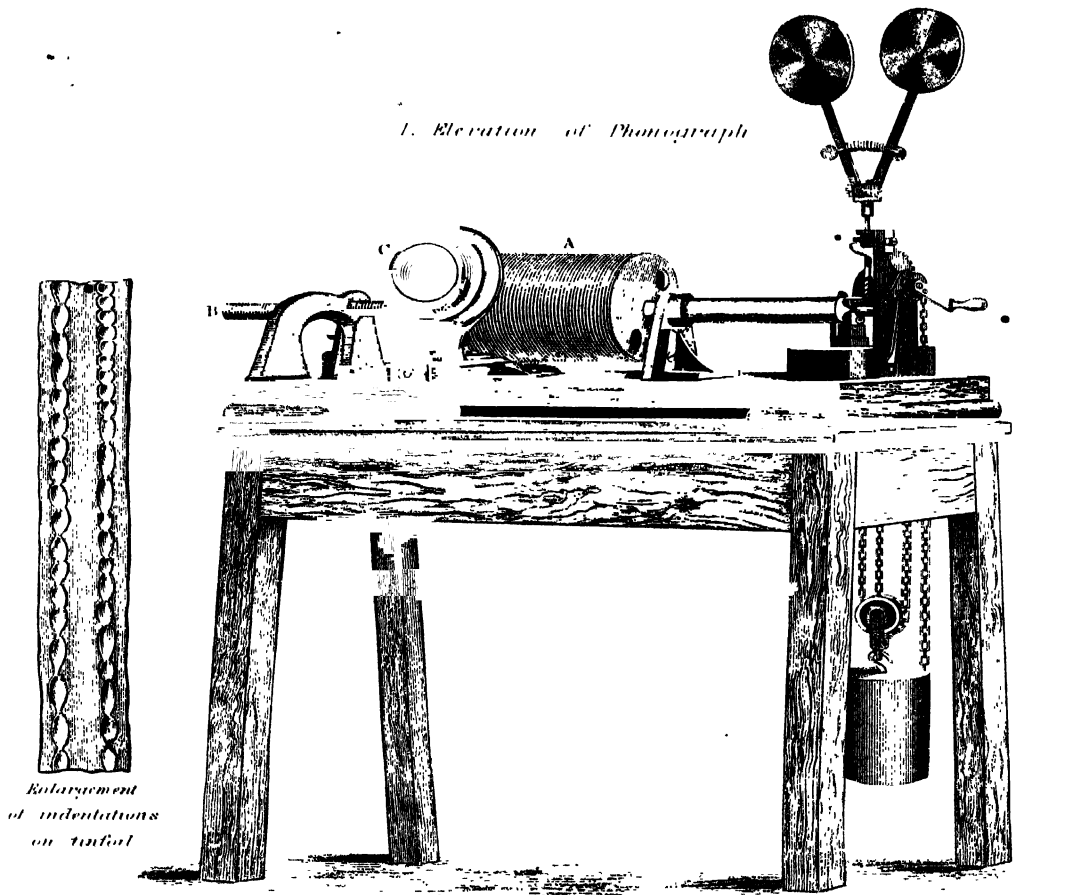
Phasianus amherstiae Amherstiae Phasianus.

Phasianus nivalis Phasianus.



PHONOGRAPH.

1. Elevation of Phonograph



Details of mouthpiece, diaphragm & needle.



PHOTO-GRAVURE FROM NATURE BY KLIC'S COPPERPLATE PROCESS

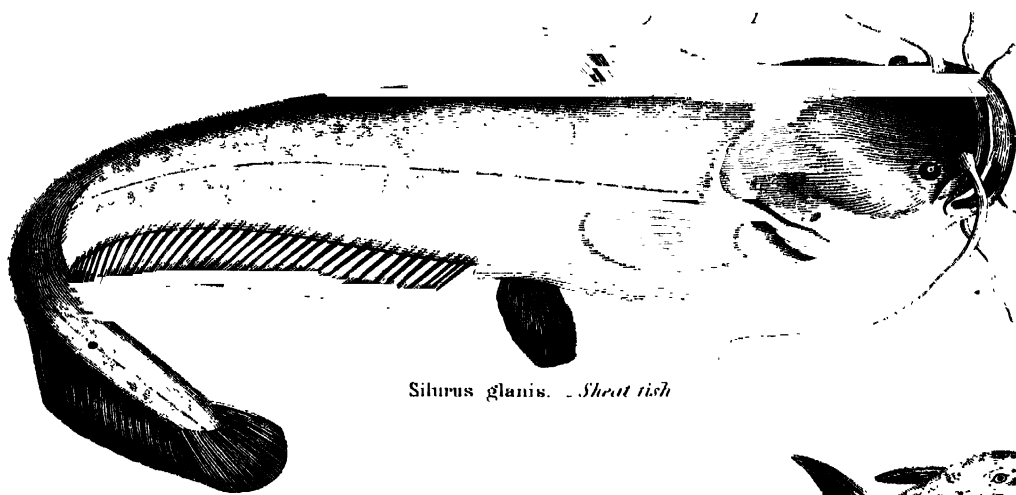
PHOTOGRAPHY.

PLATE 2.

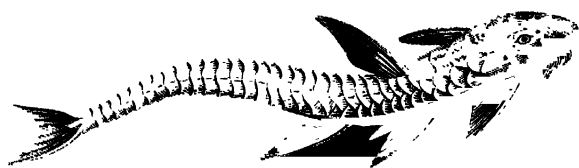


PHOTOGRAPH FROM NATURE, ENGRAVED BY THE DALLASTINT PROCESS.

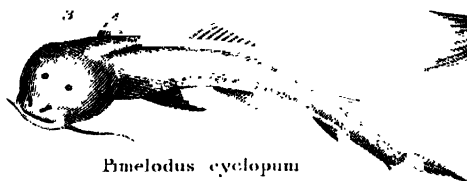




Silurus glanis. — *Sheat fish*



Loricaria cirrhosa



Amelodus cyclopus



Saurus fetens.



Cyprinus carpio. — *Carp*

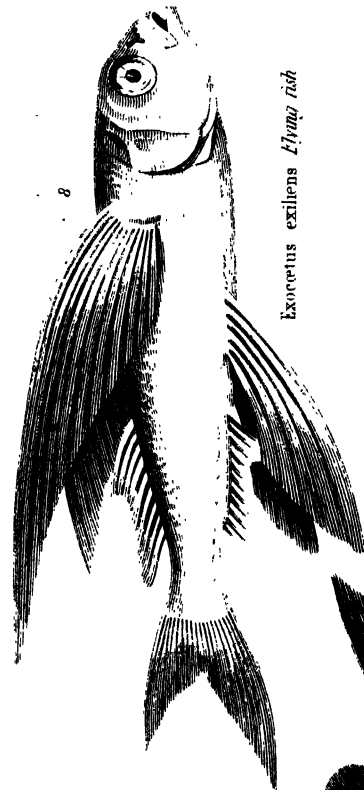


Misgurnus fossilis. — *The Burrowing Loach.*

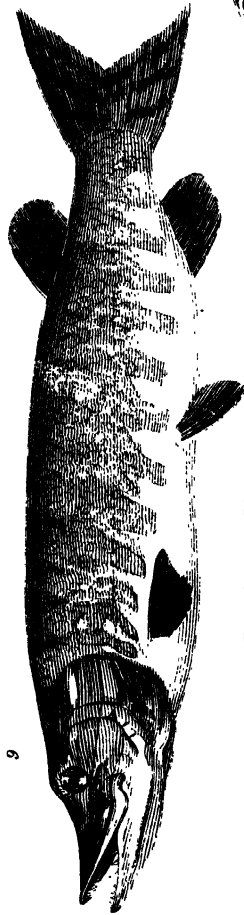
1
2



Anableps tetraodon. Four-eye



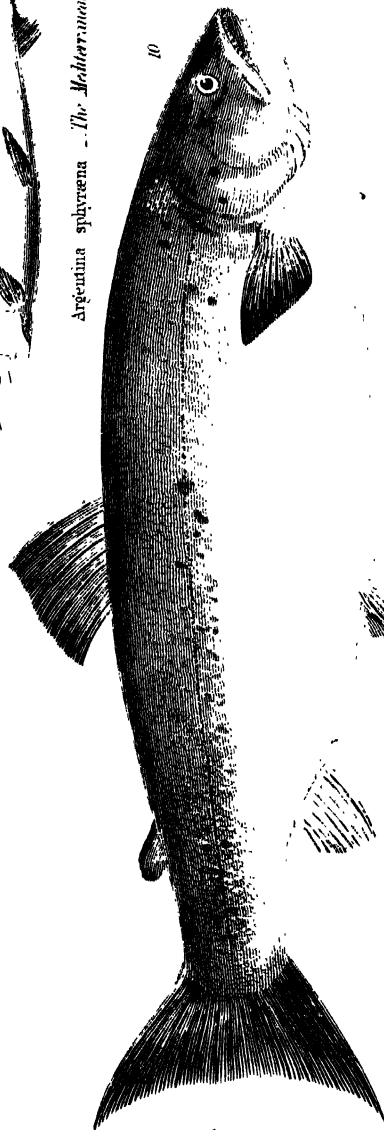
Exocoetis exilis. Flying fish



Esox lucius. Pike



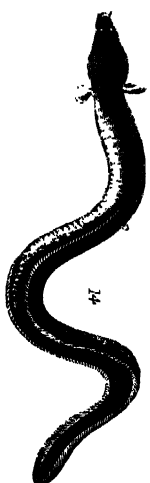
Argentinus sphyraena. The Mediterranean Sphyraena



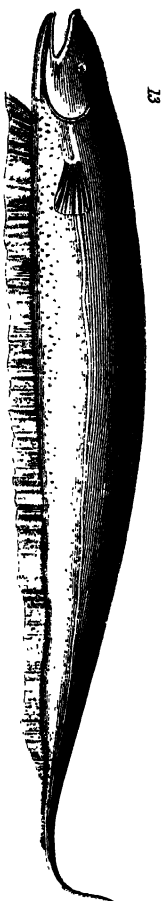
Salmo salar. Salmon



Clupea harengus. Herring

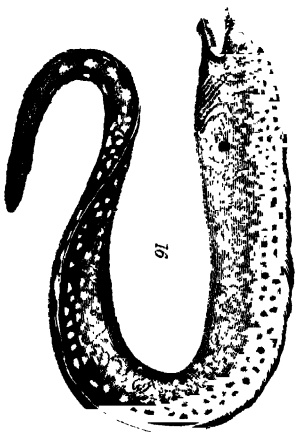


Anguilla vulgaris. - Common Eel.



Conger vulgaris. - Conger

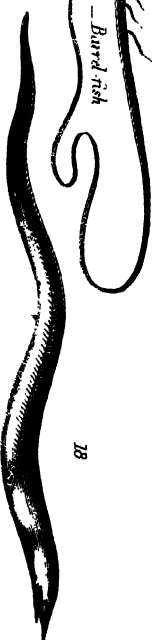
Gymnotus equibianus. Electric Eel.



Muraena melanocephala



Saccopharynx ampullaceus. - Burd fish



Sphegocnemis rostratus.

LIST OF PLATES.

VOL. X.

To be Bound at Commencement of Volume in Following Order.

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ORCHIDEÆ,	„ I.
ORDERS OF MERIT,	„ I.-II.
ORGAN,	„ I.-III.
ORGAN PIPES,	„ I.
ORRERY,	„ I.-II.
ORTHOPTERA,	„ I.
OWL,	„ I.
PANAMA CANAL,	COLOURED MAP.
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PERSIAN ARCHITECTURE,	„ I.
PHEASANT,	„ I.
PHILÆ,	„ I.
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PHYSOSTOMI,	„ I.-III.

NATIONAL ENCYCLOPÆDIA: ¹⁸⁹⁸

A DICTIONARY OF

. UNIVERSAL KNOWLEDGE.

NEWBURY.

NEWBURY, a municipal borough and market-town of England, in the county of Berks, situated on the right bank of the Kennet, 16 miles W. by S. of Reading, and 53 miles from London by the Great Western Railway. It is an ancient place. The principal streets are broad and well paved. The church is a plain stone restored building, erected in the time of Henry VII. by the famous "Jack of Newbury." There is a district church in the Gothic style, on the London road, and places of worship for various denominations of dissenters. The town also possesses municipal offices, a school called the Newbury Bluecoat School, which is richly endowed, a literary and scientific institution with a good library, and some almshouses. There are several large malt-houses and corn-mills, and some manufactures of silk and paper; and a great wool market is held annually. The population in 1881 was 10,144. The corporation consists of six aldermen and eighteen councillors. The regalia is interesting.

Newbury is supposed to have been the Roman *Spina*. It was formerly celebrated for its manufacture of serges and shalloons; and in the reign of Henry VIII., John Winchcomb, known as "Jack of Newbury," kept 100 looms, from the produce of which he became so wealthy as to be able to entertain the king and his retinue during their passage through the town. This "Jack" furnished 100 of his own men, clothed and paid them, for King Henry, and sent them to Flodden Field. The vicinity is remarkable for two battles fought during the Civil War between the royalist and parliamentary forces, Charles I. commanding his army in person on both occasions. The first was fought on a common called the Wash, on 20th September, 1648; the second on 27th October, in the following year; but neither had any decided result. At the first battle Lord Falkland fell, and a handsome memorial has been erected to him and to Lords Carnarvon and Sunderland, and other royalist officers who fell in this engagement. Donnington Castle, a short distance north-west of Newbury, was the property of Chaucer, and in it he spent the two last years of his life, which terminated in 1400.

NEWBURY (or **NEWBOROUGH**), **WILLIAM OF**, a valuable English chronicler of the time of Richard I., was a monk of the North Riding of Yorkshire, born at Bridlington, and trained by the great monastery of Austin Canons at Newbury. He wrote in Latin, about 1198; and gave the "History of England" from the Conquest to his own time very concisely, enlarging when he dealt with events of which he had knowledge at first or at second hand. He died in 1208, aged seventy-two.

NEWCASTLE, a town of New South Wales, and the principal shipping port on the northern coast, the amount of its tonnage being very little below that of Sydney, from which it is distant about 75 miles north. It is situated at

NEWCASTLE-UNDER-LYME.

the mouth of the river Hunter, on the south bank. The entrance to the harbour is dangerous in E.S.E. stormy weather, but an extensive breakwater has been constructed which has reduced the risks of entrance. The depth of water at the shores is about 22 feet. Nearly all the produce of the Hunter River district finds its way to Newcastle for shipment; but the chief article of shipment is coal, of which enormous quantities are exported. The harbour is defended by a fort. The town is well laid out, and being chiefly situated on sharply rising ground is very healthy. Its chief buildings and institutions are a court-house, an hospital, a post-office, a lunatic asylum, grammar-school, school of arts, several large churches belonging to the Episcopalians, Presbyterians, Wesleyans, Congregationalists, Primitive Methodists, Baptists, and Roman Catholics, theatre, market-hall, and custom-house. The population in 1881 was 15,595. There are copper works, an extensive brewery, shipbuilding yard, fellmongery, steam biscuit factory, carriage factories, foundries, and engineering establishments. The mouth of the Hunter River, formerly called Port Hunter, but now known as Newcastle Harbour, was discovered on 16th September, 1797, by Lieutenant Shortland, while on an expedition to Port Stephens in search of runaway convicts. He called the stream the Coal River, from the fact of having found some pieces of coal on the banks.

NEWCASTLE-UNDER-LYME, a municipal and parliamentary borough of England, in the county of, and 16 miles N. by W. from Stafford, and 152 from London by the North-western Railway, is situated at the edge of the Potteries, and connected by a branch with the North Staffordshire Railway. The origin of the word Lyme or Lyne is uncertain, but is generally supposed to refer to an ancient forest so called, which was situated in Cheshire, and thus intervened between Newcastle-under-Lyme in Staffordshire, and Ashton-under-Lyme in Lancashire. A small river bearing the same name runs near the town on its western side. Newcastle is an ancient place, and was formerly considered the capital of the Potteries, but Stoke has now obtained that distinction. Till within a few years its streets and buildings were inferior to most towns of its size in England, but recently numerous magnificent buildings have arisen, and elegant streets sprung up, chiefly through the enterprise of one individual; and there is now a good supply of water. Newcastle contains a guildhall, free grammar-school, almshouses, churches, places of worship for dissenters, literary and scientific institution, and museum. Large numbers of hats were formerly made in the town, but this branch of manufacture has declined, and the chief industrial establishments are carriage and shoe factories, nail and pipe works, and potteries. There are also cotton, silk, and paper mills, and tanneries and

breweries, and in the vicinity are some ironworks and collieries. The town has a trade in corn and flour. The municipal borough is divided into two wards, and is governed by six aldermen and eighteen councillors. The population in 1881 was 17,508. The parliamentary borough returns one member to the House of Commons. The town gives the title of duke to the Pelham-Clinton family. Of the castle, built by the Earl of Chester in 1180, and whence the town takes its name, but slight traces remain. Near Newcastle is Trentham Hall, a magnificent seat of the Duke of Sutherland.

NEWCASTLE-UPON-TYNE, the commercial metropolis of Northern England, is a city and county in itself, the seat of a bishopric, a parliamentary borough, a market-town, and one of the great ports of the kingdom. It is situated on the northern bank of the Tyne, which, for a considerable part of its course, divides the counties of Northumberland and Durham. It is one of the principal stations on the east coast route from England to Scotland. From London by railway it is distant 272 miles, from Edinburgh 125 miles, from Carlisle 60 miles, and from the mouth of the Tyne 9 miles. The population in 1881 was 145,359.

The site upon which Newcastle has grown up was one of the fortified stations of the great mural barrier which imperial Rome built across the island to protect her conquests in Northern Britain. A bridge by which the conquerors united the opposite shores of the Tyne at this point was named, in honour of the Emperor Hadrian, who was of the *Ælian* family. *Pons Ælii*, and by that appellation the station is designated in Roman history. After the Romans had departed station and bridge fell into decay, and so remained with various renovations for nearly 700 years. But when the Normans came, the monarchs of that race, appreciating the natural advantages of the site, restored the bridge, raised a fortress on the rocky mound overlooking it, and laid the foundations of a practically impregnable stronghold. Their successors completed the work, and thus, taking its name from the fortress, "the king's town of the New Castle upon the Tyne" came into existence, grew, and flourished. Surrounded by massive walls, east, north, and west, and protected by the deep rolling river on the south, Newcastle was for many generations a bulwark against the Scots, and a sure defence against all other enemies of the crown. The fighting sovereigns of England, from John down to the later Henries, mustered their armies here to march against Scotland, and not unfrequently came hither themselves to deliberate upon matters affecting the happiness and well-being of both nations. Within the walls of Newcastle Scottish monarchs twice rendered homage to English kings for their crowns, and on many occasions plenipotentiaries from the two kingdoms met here to arrange truces and settle terms of peace. During the Civil War the town was taken by the Scots, who held King Charles I. a prisoner in it, whence he was handed over to the victorious Parliament. After the abortive attempts to replace the Stuart dynasty on the English throne, neglect and decay and the natural development of the community caused the gradual destruction of these extensive fortifications, and at present only the keep and a gate of the castle and a small portion of the town wall remain to tell of the time when Newcastle was one of the strongest military posts in the kingdom.

In the Parliament that assembled at Westminster in 1295 Newcastle was represented by two burgesses, and it has nearly ever since returned two members.

From an early date the burgesses held the town of the king by a fee farm rent, which continued to be paid (£100 per annum) until 1885, when it was purchased by the corporation from grantees under the crown. In return for various services during the wars they received numerous charters and grants, and acquired upon easy terms considerable landed estate. In 1891 Richard II. gave the mayors

the privilege, which they continue to exercise, of having a sword of honour carried before them. In 1400 the town was made a county in itself, and the burgesses were empowered to elect a sheriff to receive and execute the king's writs. A diocese of Newcastle, with Dr. Ernest R. Wilberforce as its first bishop, was created in 1882, on which occasion the queen conferred upon the town the title of city. Newcastle is divided into nine wards, and the municipal government is vested in sixteen aldermen and forty-eight councillors, who elect a mayor and sheriff every year. The crown appoints a recorder, who presides at quarter sessions within the borough, and in one or two courts of local jurisdiction. Justice is administered by a bench of thirty-two magistrates, of whom the mayor for the time being is chief.

Before the Reformation several monasteries and a nunnery flourished in Newcastle. Nothing remains of them but the disfigured quadrangle and chapel of the Black or Dominican Friars in the Westgate. The old parish churches of St. Nicholas, St. Andrew, and St. John have been restored; that of All Saints was rebuilt at the close of last century. St. Nicholas, with its beautiful lantern-crowned tower, dates from 1359, and is now the cathedral church of the diocese. There are eleven other churches in the city having cure of souls, and two belonging to charitable foundations. Non-conformists are numerous in Newcastle, and their churches and chapels are divided among the respective denominations as follows:—Methodists of all kinds, forty one and eight mission rooms; Presbyterians, ten; Roman Catholics, five; Congregationalists, five; Baptists, three; Unitarians, Swedenborgians, Quakers, Lutherans, Glasites, Irvingites (Catholic Apostolic), Christadelphians, Jews, Plymouth Brethren, and the Churches of Christ, one each. Other religious agencies are the Sailors' Bethel, Young Men's Christian Association, Gospel Temperance Mission, Home Mission, and the Salvation Army. Charities and charitable organizations are abundant. The Hospital of St. Mary the Virgin, Ryehill, dates from the reign of Henry I., and provides for a master and eight brethren; some of its funds have been diverted to purposes of education. The Mary Magdalen Hospital, Barras Bridge, is a foundation of great antiquity, and maintains a master and sixteen brethren. Holy Jesus Hospital, in the Manors, founded in 1682, contains seven men and thirty women. The Keelmen's Hospital, City Road, was erected by the keelmen of the Tyne in 1701, and shelters decaying members of that body, who maintain it by periodical subscriptions. Deaf mutes are trained to useful occupations in a fine building adjoining the town moor, and the blind are cared for in a convenient asylum in Northumberland Street. The infirmary is a spacious erection overlooking the cattle market, with a noble adjunct on the sea-coast known as the Whitley Convalescent Home. Among other institutions of a benevolent character are the dispensary, lying-in hospital, boys' orphanage, girls' orphanage, Trinity almshouses, eye infirmary, female penitentiary, nurses' home, home for the aged, infants' nursery, training home for girls, fever hospital, boys' refuge, aged females' society, indigent sick society, servants' institute, and workshops for the blind.

Newcastle is the centre of a great mining and manufacturing industry. Underlying the counties of Northumberland and Durham are vast beds of coal, for the products of which the river Tyne has been for centuries the principal outlet. Shipbuilding and navigation are the natural auxiliaries of mineral traffic, and so long ago as the time of the later Tudors the Tyne possessed a considerable fleet of home-built ships, manned by local seamen, which carried away coal and brought back corn and other merchandise to Newcastle. In the year 1800 the number of vessels built in the river was forty-seven, and their aggregate tonnage exceeded 11,000 tons; while the coal trade and its affiliated industries employed nearly 2,000,000 tons of

shipping, with keels, wherries, and small craft innumerable. Then came the application of steam to machinery and locomotion. It was in the neighbourhood of Newcastle that the first successful locomotive engine saw the light, and there, as was most fitting, the beneficial effects of the new motive power were most strikingly exemplified. The coal trade was developed with great rapidity; forges, foundries, and engineering establishments sprang up to meet the demand for mechanism, and all kinds of industries, old and new, that required mineral fuel for their successful exploitation were brought to Newcastle, where their necessities could be abundantly and cheaply supplied. When the railway system had spread itself all over the country, and other fields of coal began to compete with those of Northumberland and Durham, another invention was devised—an invention scarcely inferior in its beneficial influence upon local commerce to that which followed the introduction of steam. This was the iron screw collier, the forerunner of a great fleet of iron steamships specially designed for the coal trade, and the parent of the dead-weight cargo carrying steamer in which, to-day, the greater part of the maritime commerce of the world is conducted. Contemporaneously came the invention of the hydraulic engine, by which enormous weights are lifted with ease and moved with safety, and, soon after, that of rifled ordnance, which has been adopted by all maritime nations. Newcastle claims to be the nursery of the coal trade, the cradle of the locomotive, and the birthplace of the screw collier, hydraulic machinery, and rifled artillery. Along the banks of the Tyne, from Blaydon to Shields, mostly with headquarters in the city, are engineering works, shipyards, and manufactories whose names and achievements have become historical. The firms of Robert Stephenson & Co. and Hawthorn & Co. are known throughout the engineering world. Equally diffused is the reputation of the great shipbuilding and iron establishment of Palmer's Company at Jarrow, and the gigantic works founded by Sir William Armstrong and partners at Elswick. The names alone of T. & W. Smith, William Milburn & Co., Hawks & Crawshaw, John Abbot & Co., Locke, Blackett & Co., Cookson & Co., Walkers, Parker & Co., Joseph Cowen & Co., Hugh Lee Pattinson & Co., Charles Tennant & Co., and the Jarrow Chemical Company suggest great undertakings in ships and shipping, iron and lead, fire-clay goods and chemicals. It is not possible to describe the multifarious industries which are concentrated around Newcastle; but the volume of trade upon the Tyne is exhibited in the following statistics derived from official sources.

The number and tonnage of British and foreign sailing and steam ships, including their repeated voyages, that entered and cleared with cargoes and in ballast from and to foreign countries, British possessions, and coastwise in the Tyne for the following years were:—

Years.	Vessels.	Tonnage.
1882, . . .	33,592	12,445,704
1883, . . .	32,911	13,042,688
1884, . . .	32,736	13,508,643

The principal articles of local production exported during the same period were:—

	1882. Tons.	1883. Tons.	1884. Tons.
Coals and coke, . . .	8,308,843	9,599,421	9,721,023
Chemicals, . . .	289,810	275,489	258,803
Cement, . . .	41,668	39,798	45,005
Copper, . . .	9,228	12,912	11,894
Fire-clay goods, . . .	120,264	146,071	150,958
Grindstones and millstones, . . .	11,434	9,471	9,310
Iron and steel, . . .	221,546	161,335	149,002
Lead goods, . . .	38,826	33,696	35,829

Among the vessels, in 1884, was one of 2900 tons net register, and ten others exceeding 2000 tons.

The number and net tonnage of steam and sailing vessels built on the Tyne of iron, wood, and steel, were:—

Years.	Vessels.	Tonnage.
1882, . . .	140	134,407
1883, . . .	168	141,355
1884, . . .	138	97,388

The administration of river affairs was taken from the corporation of Newcastle in 1850 and placed in the hands of the River Tyne Commissioners—an elective body who meet in Newcastle. Under their management three large docks have been constructed, protecting piers built at the sea entrance, and the river deepened to about 20 feet at low-water spring tides from Newcastle to Shields. Simultaneously the quay at Newcastle has been rebuilt by the corporation, and now extends nearly a mile, with deep-water berths, public cranes capable of lifting weights up to 80 tons, wharves, warehouses, and transit sheds. Steamers sail regularly from Newcastle to London, Ipswich, Yarmouth, Lynn, Hull, Leith, Dundee, Aberdeen, Copenhagen, Malmo, Aarhus, Randers, Bergen, Stettin, St. Petersburg, Gothenburg, Hamburg, Amsterdam, Rotterdam, Antwerp, Ghent, and other continental ports; also to the Mediterranean and to America. Three bridges connect the city with the town of Gateshead. Two of them are of special construction, and demand special consideration. The high-level bridge, designed by Robert Stephenson and opened in 1850, carries the railway across the Tyne upon six arches of open ironwork, each of 125 feet span, resting upon stone piers rising from the bed of the stream. Beneath the railway are a carriage road and two broad footways, the railway forming a roof to the roadway. The height of the bridge from high-water mark to the carriage road is 85 feet, and the railway is 27 feet higher—total, 112 feet; length, 1337 feet; width, 32 feet. The cost of the bridge itself was £243,096, and of the land and approaches £248,057—altogether nearly half a million. The swing bridge occupies the site of the old Roman viaduct, and was completed in 1876. It consists of four openings, the two central ones, 104 feet wide, being spanned by girders pivoted on a massive stone and concrete pier, which descends to the solid rock 45 feet below low-water mark. The superstructure, of wrought-iron, was made by Sir William Armstrong & Co., who also supplied the hydraulic machinery by which the central girders, weighing 1450 tons, are opened to allow the passage of masted vessels up and down the river.

The main line of the North-eastern Railway connects Newcastle with all parts of the kingdom, while local branches open up communication with ports upon the north-east coast, the Northumberland and Durham coalfields, the hills of the Border, the west coast, and the Lake districts of Cumberland and Westmorland. Within the city are tramways that run from the central parts to Ryker in the east, Gosforth in the north, and Elswick and Scotswood in the west.

Markets for cattle are held on Tuesdays, and for grain on Tuesdays and Saturdays. Large numbers of fat cattle, butter, cheese, eggs, &c., are imported from Scandinavian ports, and the supply of grain is extensive and important. There are also separate markets for hay, hides and skins, neat cattle, birds, fish, meat, and vegetables.

Newcastle is well provided with parks and recreation grounds. The largest of them it owes to the munificence of Sir William Armstrong, who added to a public park at Heaton, on the east side of the city, a romantic valley named Jesmond Dene, which he had planted and beautified for his own use, including an ornamental iron bridge costing £30,000, and a capacious banqueting-hall. Leazes Park, near the town moor (itself a fine open space of nearly

1000 acres), is the place usually selected for flower shows and firework displays. Elswick Park supplies the west end of the city with verdure, and contains a collection of models of the works of the deceased sculptors Lough and Noble—the former a native of the district. Amusements are furnished by two theatres, a circus, and the usual concert rooms and music halls; literature and politics by seven weekly, four morning, and two evening newspapers—the oldest of them, the *Newcastle Courant* (weekly), dating from 1711.

Among the public buildings of Newcastle the following are notable:—The *Old Castle*, stored with antiquities, and the home of the Newcastle Society of Antiquaries; the Black Gate of the castle, which has been repaired and fitted up as an antiquarian museum; the Guildhall, on the Sandhill, where the incorporated companies meet, and the commissions of assize and gaol delivery for the city are opened; facing it are some ancient houses, from one of which Bessy Surtees, a banker's daughter, eloped with John Scott, a native of Newcastle, afterwards Lord Chancellor Eldon; the Moot Hall, adjoining the castle, where the assizes and sessions are held, and other business of the county of Northumberland is transacted; the general post-office, near St. Nicholas' Church, and the town-hall close by, containing the municipal offices, a concert room seating 3000 persons, the corn exchange, &c.; the library of the Literary and Philosophical Society, and the Wood Memorial Hall attached thereto, where the Coal Trade Association, the College of Physical Science, and the Institute of Mining Engineers are located; the Union Club, between St. John's Church and the offices of the *Newcastle Chronicle*; the savings bank, the county court, and the assembly rooms beyond; the Catholic cathedral, facing the Central Railway Station; the royal grammar-school in Westmorland Road, a modern erection, replacing the famous schoolhouse at the Virgin Mary Hospital, in which Lords Collingwood, Eldon, and Stowell, and many other local worthies, received their early education; the infirmary, and the cattle market surrounding it; the central exchange, art gallery, and news-room, a fine building formed by the junction of Grey, Grainger, and Market Streets; the Free Library in New Bridge Street, opened by the Prince of Wales in 1884, in which is placed a valuable collection of books illustrating the history, manners, and industries of the northern counties; the central police court and magistrates' chamber in Pilgrim Street; the drill hall and riding-school at the end of Bath Road; the Natural History Society's Museum, erected at a cost of £40,000, also opened by the Prince of Wales, and containing John Hancock's collection of birds, a fine display of fossils from the coal measures, and relics of Thomas Bewick, the wood engraver; the deaf and dumb asylum, and the boys' and girls' orphanages on the town moor; the city gaol in Carlisle Square; the industrial dwellings, Garth Heads; the grain ware-houses on the quay; the barracks on the Ponteland Road, and the city lunatic asylum at Gosforth. There are two public monuments in Newcastle—a column which commemorates, at the union of Grey, Blackett, and Grainger Streets, the services of Earl Grey the reformer, and a bronze group in Neville Street, opposite the Central Railway Station, in honour of George Stephenson the railway pioneer.

Numerous institutions devoted to inquiry and research in various branches of knowledge, have their home in Newcastle. The Society of Antiquaries, which, as before mentioned, meets in the Old Norman Keep, has published fourteen volumes of the *Archæologia Æliana*, containing elaborately illustrated papers and essays, rich in Roman inscriptions and mediæval records. The Tyneside Naturalists' Field Club numbers several hundred members, and has issued nine or ten volumes of *Proceedings*. The Northern Institute of Mining and Mechanical Engineers is a flourish-

ing body, and its *Transactions* appear in thirty portly volumes, copiously embellished with maps, plans, and sections. Besides these there are societies for chemical, microscopical, architectural, and pathological investigations, and an association of colliery engineers, with frequent meetings for reading of papers and discussions and occasional conversaziones and lectures. Education in its higher branches is represented by a college of physical science, a medical college, a school of art and design, a science and art school, and a students' association. The colleges of physical science and medicine are in connection with the University of Durham. Lectures on scientific and literary subjects are provided twice a week during the autumn and winter seasons by the Literary and Philosophical Society.

Among the men whom Newcastle delights to honour, either as natives or life-long residents, are Horsley, the historian of Rome in Britain; Akenside, the poet; William and Elizabeth Elstob, Saxon scholars; Avison, musical composer; Charles Hutton, mathematician; Lord Chancellor Eldon and his brother Lord Stowell; Admiral Lord Collingwood; Thomas Bewick, engraver; George Stephenson and his son Robert, railway engineers; Thomas Miles Richardson and J. W. Carmichael, painters; Richard Grainger, who built the noble streets that occupy the heart of the city; Thomas Doubleday, historian, political economist, and song writer; and among the living, Sir William Armstrong, engineer and inventor; Dr. John Collingwood Bruce, antiquary; Sir Lowthian Bell, ironmaster and author; John Hancock, naturalist; Charles Mark Palmer, shipbuilder and inventor, and Joseph Cowen, politician.

NEWEL, in architecture, is the upright central pillar supporting a geometrical staircase. It is a corrupt spelling of *nucel*, which comes from the Latin *nucleus*, a core; and that is a variety of the word *nuc*, *nucis*, a kernel or nut. A *nucleus* or *nucel* is therefore an apt name for this "spindle of a winding stair." The word is now also used for the large carved posts which occur at the beginning and ending of each section of a wooden staircase.

NEWFOUNDLAND, the earliest British colony, an island situated in the Atlantic Ocean, reaching out at the furthest point of America towards the eastern hemisphere, thus forming, as it were, a stepping-stone between the Old World and the New. At its south-western extremity it approaches within 50 miles of the island of Cape Breton, while its most eastern projection is but 1640 miles distant from Ireland. Its population in 1881 was 161,374, and its area was estimated at 42,000 square miles; but, strange as it seems, up to the present time the interior is almost unknown, while the mere existence of certain splendid fertile valleys in portions of the island has only been discovered in quite recent times. The appearance of the coast is rocky and forbidding, but there are a great number of deep bays and fiords, containing magnificent harbours, and piercing the land for 80 or 100 miles, while the sides present varied scenes of beauty, such as are rarely surpassed in the world's most favoured lands. The effect of these inlets is to give the island the enormous coast-line, compared to its area, of more than 2000 miles. The loftiest range of mountains, the Long Range, has a few summits of more than 2000 feet, but the elevations of the island rarely exceed 1500 feet. The Long Range extends along the western side of the island. As far as is known the chief river is the Exploits, with its mouth in the Bay of Exploits in Notre Dame Bay. Lakes are very numerous; the chief are Grand Lake, with an area of 192 square miles, Red Indian Lake, with an area of 64 square miles, and the Gander and Deer Lakes.

The western side, where the climate and soil are equal to the most favoured shores of the mainland, is a splendid site for the agriculturist. Tobacco and wheat have been grown there at a profit. In the interior it is impossible to

say what may yet be discovered. It is known, however, that large tracts exist not far inland where cattle can be reared, and, if due advantage were taken of this, it would be easy to establish the export of cattle as one of the most remunerative industries of the island. Fishing, however, is still the staple industry, and the people look with suspicion upon any other harvest than that of the sea. They have a saying that an acre of the sea is worth 1000 acres of land, but it cannot be denied that the fisheries are more precarious and less remunerative than formerly. The cod fisheries are, however, still the most extensive in the world. The fish are taken on the shores of the island, on the banks, and along the coast of Labrador. The bank fishery is now chiefly prosecuted by the French and Americans, Newfoundlanders occupying themselves mainly with the shore and Labrador fishery. The next in importance is the seal fishery. The seals are taken on the floating ice-fields in the spring, and the introduction of steam has led to the prosecution of the trade to a later season. The rivers yield magnificent salmon. Herrings are caught in large quantities, but mackerel are no longer found in Newfoundland waters. The plains abound with herds of caribou deer, and bears, foxes, and wolves are numerous. A parallel to an Act once in force in England is that offering a reward for every wolf killed. The dogs for which the island was famous have degenerated, and better Newfoundland dogs can be seen and bought in England than in Newfoundland itself.

The mines are very valuable, and Newfoundland now ranks as the sixth copper-producing country in the world. Lead mines have also been discovered and worked. There is good reason for believing that gold and coal will yet be found. A railway from east to west has been projected, which would not only have a very powerful effect in opening up the rich interior, but would do much to shorten the sea journey between America and Europe. Newfoundland is connected at St. John's, the capital, with Europe by the Atlantic cable.

Almost alone among Transatlantic colonies Newfoundland can boast of having borrowed in its home market, and of having done so at the moderate interest of a fraction over 4 per cent. The public debt in 1886 was £340,000; the revenue and expenditure of the colony each average about £250,000 per annum. Responsible government was granted in 1855. The governor is appointed by the crown, and is assisted by an executive council of seven members, an upper house of fifteen members, and a house of assembly formed of members elected by the people. The Mic Maes, the aboriginal inhabitants, have now entirely perished. The climate is healthy, but the southern and south-eastern sea-boards are foggy and humid, though it is said that the fog seldom penetrates far inland. It not infrequently happens that at St. John's a dark wall of fog is visible out at sea, while sunshine and genial weather prevail on shore, and during southerly winds the great bays on the sea-coast become receptacles of the sea fog.

The first discovery of Newfoundland is due to some Norwegians, who, before the year 1000, sailed on a voyage of discovery from Greenland, and visited various parts of North America. The existence of Newfoundland, however, seems to have been forgotten until its rediscovery, on the 24th June, 1497, by John Cabot, then in the service of England. By the year 1500 fishermen reached as far as Newfoundland from Europe. No attempt was made to form a settlement on the island until 1536; and no success attended any attempts until the next century, when Lord Baltimore in 1623, Lord Falkland in 1633, and Sir David Kirk in 1654, formed settlements on the island, which has ever since belonged to England; but there have been repeated disagreements between England, France, and America respecting the rights of fishery there.

NEWFOUNDLAND BANKS, THE, are rather a submarine plateau than banks in the ordinary sense. The bottom is rocky, and generally reached at from 25 to 95 fathoms; length and breadth, about 300 miles; they are the only shallow region of the wide Atlantic. Fish resort to the banks in great numbers, but are not found there exclusively. The banks stretch south and south-east from the island.

NEWFOUNDLAND DOG is a well-known and very muscular variety of the canine family. The huge and, it must be confessed, handsome dogs which are so often seen in this country, and pass for Newfoundland dogs—"dogs as big as a jackass and as hairy as a bear"—are very different from the compact and moderate-sized animals which in their native country are employed in drawing sledges and little carriages laden with wood, fish, or other commodities. Some of these true Newfoundland dogs make admirable retrievers. Of the aquatic propensities and powers of this breed of dogs little need be said. Numerous are the instances which might be collected of the gallant manner in which they have rescued human beings from a watery grave. Sagacity, courage, and fidelity are the characteristics of this noble race. The Newfoundland dog stands about 30 inches high at the shoulders. The body is covered with thick curly hair, usually black or black and white in colour; and the toes are webbed.

NEWHAVEN is a seaport town of England, in the county of Sussex, 8 miles south-east of Lewes, and 56 from London by the Brighton and South Coast Railway. Its harbour has been improved and the course of the river diverted a short distance above it, and a swivel bridge erected. The average depth of water at the mouth of the harbour is 21 feet at spring tides, 16 to 17 feet at neap tides. The chief imports from the Continent consist of silks, wine, butter, eggs, and fruits. The exports in transit are considerable. Steamers ply regularly throughout the year to Dieppe, and some very extensive docks were constructed by the London and Brighton Railway Company in 1885-86. It was here that Louis Philippe landed as a fugitive in 1848, having crossed from Tréport in an open fishing-boat. The church, a small Norman building, stands on a hill to the west of the town. There are a ship-building yard and an extensive brewery. Some strong fortifications have been erected near the town. The ancient name of Newhaven was *Meeching*, but when, in the reign of Elizabeth, the channel of the Ouse was diverted from Seaford and made to enter the sea in a straight line southward, the present appellation was adopted. The population of the township in 1881 was 4009.

NEWHAVEN, a city and seaport, and with Hartford the joint-capital of CONNECTICUT, United States, is situated on an inlet of Long Island Sound. It is 72 miles north-east of New York, with which it has steamboat communication daily; it is also connected by railway, as well as Hartford, with Boston (116 miles north-east) and several other towns. It is situated within an amphitheatre of hills, and is regularly built, having elegant squares and several fine buildings. It has over sixty churches; Yale College, with the finest mineralogical cabinet in the United States, and an anatomical museum; a state house, state hospital, a fine park, academies, and benevolent institutions; and a beautiful public cemetery. The harbour has fine wharves, and the coasting, fishing, and foreign trade is large. Manufactures of woollen cloths, leather, clocks, machinery, and hardware are carried on. It was colonized from London in 1638. The population in 1880 was 62,882.

NEWMAN, CARDINAL JOHN HENRY, an eminent theologian, was born in London, 21st February, 1801, where his father was a partner in a banking-house. Educated at Ealing, he proceeded in 1816 to Trinity College, Oxford, that year being also marked by some religious

experiences which, nearly fifty years afterwards, he described as "an inward conversion of which I am more certain than that I have hands and feet." He became a scholar of this college by competitive examination in 1818, graduated in 1820, and was elected fellow of Oriel College in 1822. Here he attracted the notice of Dr. Whately, through whom Newman became connected with the *Encyclopædia Metropolitana*, to which he contributed, among other articles, the "History of Roman Literature." Ordained in 1824, he was in the following year appointed by Dr. Whately vice-principal of St. Alban's Hall—Dr. Whately having that year become its principal. In 1826 he was named tutor in his own college, whereupon he resigned his vice-principalship, and in 1828 he was appointed vicar of St. Mary's, Oxford, and of the village of Littlemore in its neighbourhood. Trained in a liberal and evangelical school, his opinions had by this time undergone a complete transformation, and he became identified with a party at first known as the Oxford school, who were aiming at what they believed to be the restoration of the catholic character of the Established Church. The leading spirit of this movement at the outset was Hurrell Froude; and after his premature death, three men were left who became its prime movers—KEBLE, PUSEY, and NEWMAN—the latter being, in intellect and force of character, the acknowledged leader. Previous to 1833 he had published but little, his most noteworthy productions being some short religious poems, one of which, the hymn beginning, "Lead, kindly Light," has deservedly become one of the most popular hymns in the language; but in that year he published a treatise on "The Arians of the Fourth Century," and began to contribute to the celebrated "Tracts for the Times," the publication of which was commenced in 1833. In 1837 appeared his "Parochial Sermons," and in 1838 his "Lectures on Justification." In the latter year he became editor of the *British Critic*, an organ designed to promote the cause of the new party, and in conjunction with Drs. Pusey and Keble he commenced the publication of a "Library of Translations from the Greek and Latin Fathers." He wrote in all twenty-four of the "Tracts for the Times," and in 1841 he published the celebrated Tract No. 90, on the subject of the elasticity of the Thirty-nine Articles. The opinions expressed in this tract aroused a storm of opposition, and it was not only condemned by the heads of houses at Oxford, but the Bishop of Oxford called on Newman to discontinue the publication of the series, a request with which he at once complied. The *British Critic* continued to appear for some time longer, but it was allowed to expire in 1843. In the early period of the Oxford movement Newman had sharply attacked the Roman Catholic Church, and had published some very trenchant and strongly expressed criticisms of its policy; but his "Essay on the Miracles of the Middle Ages," published in 1843, and his "Lives of the English Saints," which began to appear in 1844, showed a great change of view, and in the autumn of 1845 he was formally received into its communion. In an essay on the "Development of Doctrine," he formally retracted the harsh criticisms of Roman Catholicism which he had previously published, and after a visit to Rome and a short novitiate, he was admitted to its orders. In 1848, on his return to England, he established a branch of the Congregation of the Oratory of St. Philip Neri at Birmingham, of which he was himself appointed the superior. In 1852 he was appointed rector of the Roman Catholic University of Dublin, an office which he held for five years, afterwards returning to the house of the Oratory, Birmingham, where he established a higher class school for Roman Catholics. In 1848 he published "Loss and Gain, or the Story of a Convert;" in 1850 "Anglican Difficulties;" in 1854 his "Lectures on the History of the Turks," and his "Lectures and Essays on University Subjects" in 1859. In 1861

he became involved in a controversy with Charles Kingsley, who had somewhat unadvisedly attacked him, in which he was generally regarded as victor, and this eventually produced one of his greatest works, the autobiographical record of his life, entitled "Apologia pro Vita Sua," issued the same year. In 1868 he gave the world a "Collection of Poems," of which the most important was the celebrated "Dream of Gerontius," which has been many times since reprinted. In 1870 he published his "Grammar of Assent;" and in 1875 he entered the lists against Mr. Gladstone, with a reply to the pamphlet of that statesman on the "Vatican Decrees." His reply was read with much interest, as it showed with some clearness his own doctrinal position, and while it minimized the importance of the decrees that had been assailed, it contained a strong though subtle rebuke to the dominant ultramontane faction in the Roman Catholic Church. His dislike of this faction prevented him from receiving any advancement in the church during the pontificate of Pius IX.; but when this pontiff was succeeded by Leo XIII., the latter gave a public intimation of an intended change of policy by raising Dr. Newman to the rank of cardinal-deacon in 1879. He was elected an honorary fellow of Trinity College, Oxford, 28th December, 1877.

A man of rare genius, saintly character, keen intellect, and wide scholarship, Newman has exerted a vast influence upon the Anglican Church, and also upon the Roman Catholic communion in England. A voluminous author, his works have always commanded respectful attention, but his personal influence has been much greater than that of his writings. He has always possessed a wonderful power of attracting the passionate devotion of friends and followers, his influence in this direction being specially marked in connection with ardent and thoughtful young men. J. A. Froude has stated from his personal reminiscences that at the time of the Oxford revival, the current phrase, *Credo in Neumannum*, represented for hundreds of young men a genuine symbol of faith, and that in his opinion it is still unconsciously the faith of nine-tenths of the English converts to Roman Catholicism.

NEWMAN, FRANCIS WILLIAM, younger brother of John Henry Newman, was born in London, 27th June, 1805, and like his brother was educated at a private school at Ealing, from whence he passed to Worcester College, Oxford, in 1822. He obtained a double first and Balliol fellowship in 1826; but in 1830 he resigned his fellowship, and refusing, from conscientious scruples, to renew his subscription to the Thirty-nine Articles, he quitted college without taking his master's degree. In the September of that year he proceeded to the East, with a view of undertaking missionary labour, but returned to England in 1834, when he became classical tutor at Bristol College. In 1840 he was appointed to a similar post at Manchester New College, and in 1846 he became Latin professor in University College, London. This post he resigned in 1863, to devote himself wholly to literature. His labours as an author have been wide in their range, and extend from the compilation of a volume of poetical extracts for the practice of elocution to the "History of the Hebrew Monarchy," and a paper on the "Third Elliptic Integral." He is most widely known as the author of "The Soul; its Sorrows and Aspirations" (1849); of "Phases of Faith, or Passages from the History of my own Creed" (1850); and of "Theism," a work of constructive theology, published in 1858. He has also produced an immense number of works on ethics, philology, mathematics, history, and general literature—a Berber grammar and an Arabic dictionary being among the latest of the fruits of his labours.

NEWMARKET, a market-town of England, in the counties of Cambridge and Suffolk, 13 miles west from Bury St. Edmunds, and 72½ from London by the Great Eastern Railway. It is on the whole a well-built place,

with modern houses, broad streets, some excellent hotels, a neat market-house, corn exchange, literary institution, reading-rooms, and a handsome building appropriated to the meetings of the Jockey Club. Of the two parish churches, that of St. Mary's is the more handsome, and has a tower and steeple that form a prominent feature when seen from a distance. It was restored in 1867. There are some chapels of dissenters and numerous charities. In the vicinity are many handsome mansions, the residences of some of the more distinguished patrons of the turf. The greater part of the town was destroyed by fire in 1683, and again early in the eighteenth century. Newmarket has been the headquarters of English horse-racing for upwards of 200 years; and it still owes its prosperity to its races and great training establishments. The racecourse, partly owned by the Jockey Club and partly by the Duke of Rutland, is 4 miles in length, and is justly considered one of the finest in the world. Seven race meetings are held annually, each lasting three days. The training-ground is situated south of the town, and bears a high reputation for security and convenience. Malt-making and brewing are the chief trades of Newmarket, apart from those relating to horses; but about two-thirds of the adult male population are either trainers, stable-keepers, or grooms. The population in 1881 was 5093.

NEWNHAM AND GIRTON COLLEGES, in the University of Cambridge, are institutions arranged precisely on the ordinary collegiate model, but devoted to the education of ladies instead of gentlemen. Girton is the older. It arose out of a women's college founded by several benevolent friends of women's education at Hitchen in October, 1869. Professors kindly came from Cambridge, but the arrangement proved altogether so inconvenient and unworkable that it was felt to be imperatively necessary to move to the environs of Cambridge. No house proved available, and therefore Girton College had to be built. It was completed by October, 1873. In 1876 the ladies began to be informally examined, by the courtesy of the professors of the university, in the papers supplied to the undergraduates of the other colleges, and a few years later they were openly permitted to share the university examinations.

Newnham Hall, now usually called Newnham College, was founded in 1875, and opened on 18th October in that year. Only ten years later a new building as large again as the original one had to be added. An excellent laboratory is one of the features of this college, and in 1885 the *only* first class in the natural science tripos in the whole university was taken by a "Newnham girl." Any jealousy that might once have been felt is now utterly at an end: indeed the danger is held to lie perhaps in the opposite direction, ever since one of the professors of Trinity married one of the professors of Newnham, each continuing his and her work as before. The cost of residence at either Girton or Newnham is not found to exceed £100 a year on the average. A further development of Newnham is a college for training women-teachers, which was opened at Crofton Cottages, close by, in the autumn of 1885, of which Miss Hughes, of Newnham College, was chosen as the first principal. The course of education adds to the usual university work at lectures, &c., practical instruction in teaching under the superintendence of practised educators. The corresponding establishment to Newnham at Oxford is Somerville Hall.

NEWPORT, the capital of the Isle of Wight, and a municipal borough of England, situated 90 miles from London, in a valley near the centre of the island, on the west bank of the Medina, which is navigable for small craft up to this point. The tide flows nearly to Newport Bridge, and carries large barges to the quay, which is built in front of the town, where the Carisbrooke stream falls into the Medina; but since the construction of the

railway from Newport to West Cowes the river traffic has been reduced to a minimum. The town is built on an easy ascent, and the streets cross each other at right angles. The chief buildings are the town-hall and market-house, the Isle of Wight Museum, possessing a valuable collection of antiquities, the Isle of Wight Institution, which is a public library and reading-room, and the free grammar school, a large stone edifice, erected in 1619. The conferences between Charles I. and the Parliament were held in the school-room. The negotiations were protracted over a period of three months, and terminated, 27th November, 1648, in the so-called treaty of Newport, whose provisions, however, were speedily broken by both parties. There are two assembly-rooms and a small but neat theatre. The church, dedicated to St. Thomas A'Becket, is a structure of more than ordinary elegance, built in 1854-56, in the Early Decorated style. The tower is 132 feet high. The interior contains an ancient font of curious workmanship, an old stone pulpit, a monument to Sir Edward Horsey, formerly governor of the island, and the queen's memorial to the Princess Elizabeth, daughter of Charles I., who died at Carisbrooke Castle, 8th September, 1650, consisting of a full-length effigy in marble. There are two other churches, St. John's and St. Paul's; several denominational places of worship. Parkhurst Prison, for female convicts, is in the neighbourhood of the town; and at Parkhurst, on the West Cowes Road, are important barracks, capable of accommodating fully 2000 men. The reformatory prison is celebrated for its admirable arrangements. Its two buildings will contain 700 prisoners. The house of industry, established in 1770, is managed under a local Act. Parkhurst Forest exhibits but few remains of its ancient glory, consisting now, for the most part, of young plantations. The municipal borough of Newport is divided into two wards, and is governed by six aldermen, one of whom is mayor, and eighteen councillors. The town has a trade in malt, corn, and timber, and there are some small manufactures of lace, mats, and brushes. Quarter-sessions are held here. The municipal limits include portions of the parishes of Carisbrooke, Northwood, and Whippingham. Until 1867 Newport returned two members to the House of Commons. It was then deprived of one, and lost the other under the Redistribution of Seats Act of 1885. The population in 1881 was 9357.

NEWPORT (Welsh *Castell-newydd*), a port and market-town of England, in the county of and 25 miles S. by E. from Monmouth, and 158½ from London by the Great Western Railway, is situated on the western bank of the Usk, about 4 miles above its entrance into the Bristol Channel. The river is crossed by a handsome stone bridge, and is navigable for large vessels. The town has been much improved of late years, and there is a dry dock capable of receiving the largest vessels. The Alexandra Dock, which had been seven years in construction, was opened in 1875. Shipbuilding is carried on, the river being so situated that vessels of great burden can be launched from the docks into deep water. The town also contains large iron-foundries, anchor and chain-cable manufactories, steel and tin-plate works. The district around the town abounds in collieries and iron-works, and in addition to the local consumption about 1,000,000 tons of coal are annually exported. Timber and grain are largely imported. Newport contains a most interesting parish church and places of worship for the different sects of dissenters. The market-house was rebuilt in 1865 at the expense of the Duke of Beaufort. On the bank of the river at the northern end of the town are the ruins of its ancient castle. The population in 1881 was 35,313. The municipality consists of eight aldermen and twenty-four councillors, including the mayor.

NEWPORT, the most elegant and fashionable of all American watering-places, one of the capitals of the state,

and situated on the south-west shore of RHODE ISLAND, 5 miles from the Atlantic, has 15,693 inhabitants, some of whom manufacture woollen and cotton stuffs and leather. Its harbour is defended by three strong forts. There are many large hotels and elegant villas. The scenery in the vicinity is very fine.

NEWPORT-PAGNELL, a market-town of England, in the county of Buckingham, situated near the junction of the rivers Ouse and Ousel, 45 miles N.W. by N. from London direct distance, and 56 miles by the London and North-western Railway. The town is somewhat irregularly built, but contains some good houses. The church is a large building of considerable antiquity, and was thoroughly restored in 1858. It occupies an eminence which commands an extensive view of the surrounding country. There are places of worship for dissenters and some charitable institutions. The town had formerly a very extensive manufacture of bone lace, which, though much injured by the competition of the machine lace, still employs many inhabitants. There is a coach-building establishment, and a good trade in corn, coal, and timber. The population in 1881 was 3686.

NEWRY, a seaport of Ireland, on the confines of the counties of Down and Armagh, 63 miles north of Dublin and 38 S.S.W. of Belfast, with both of which it is connected by railway. It stands on both sides of the Newry Water, which divides the two counties, and separates the town into two parts, of which the larger is in the county of Down. Newry Water discharges itself into Carlingford Lough, which is navigable for 6 miles by large vessels at all times; and the port admits vessels of 1000 tons to Warrenpoint, $6\frac{1}{2}$ miles from the town, where the larger vessels formerly remained, but those drawing 15 feet water could go up by the ship canal to the Albert basin, Newry, a distance of 5 miles from the sea; and in 1869 the navigation of the Lough was so much improved that a navigable channel was opened for all shipping. Barges ply by the Newry Canal Navigation to Lough Neagh, 32 miles distant inland. In the export of agricultural produce Newry ranks next to Belfast. Steamers sail regularly to Liverpool and Glasgow, and many vessels trade to America, the Baltic, the Levant, and other parts. The exports are chiefly flax, linen, grain, cattle, butter, and eggs. There are manufactures of linen yarn and cotton; flour and oatmeal mills; and the usual trades in connection with shipping. The retail trade of the town is also extensive. The town is handsome and well built of stone, and the streets regular and compact. There are two churches, two Roman Catholic chapels, and several meeting-houses; a union workhouse, municipal offices, hospitals, and numerous schools. Extensive water-works have been erected. The population in 1881 was 15,590. Newry was early of considerable importance, and had a castle. It suffered in the war of 1641, and was nearly destroyed by the Duke of Berwick in 1688.

NEWS PAPERS, a term applied to publications consisting of printed sheets issued at short intervals, chiefly for the purpose of giving information on current events and subjects of public interest. In modern times the earliest publication of sheets of daily intelligence was in Venice in 1563, during the war with the Turks in Dalmatia, but these were in written sheets, which were read in a particular place to those desirous to hear them.

England.—In England the origin and progress of newspapers may be described as follows:—First, there were a class of men in London employed by the county aristocracy to send them reports of all the occurrences which took place in the metropolis. These newswriters, as they were called, hurried from one coffee-house to another picking up every scrap of information they could obtain, which they regularly despatched in a written form to their employers in the country. As the craving for information increased,

there arose the ballad news, sung or recited; next, the news pamphlet; after that the periodical sheet of news; and lastly, the regular newspaper. The date 1622 has been correctly assigned as the date of the first regular newspaper published in London. Its name was the *Weekly News*, and it was under the editorship of Nathaniel Butler, who is regarded as the father of the regular newspaper press. The earliest publication of this newspaper appears to be the 23rd of May, 1622. During the time of the Civil War both armies carried their printing presses to the field of battle, and made use of lead in types as zealously as in bullets. Parliamentary intelligence and home politics were not published for several years after this date. In 1641 parliamentary news first appeared in public journals, under the title of *Diurnal Occurrences, or Daily Proceedings of both Houses in the great and happy Parliament*. From that time till the Restoration of Charles II. in 1660 nearly 30,000 journals, pamphlets, and papers were published. During the contests between the Royalists and Roundheads newspapers multiplied very rapidly, and at that time people were encouraged to read and discuss controversial writings. On the outbreak of the plague in London the royal family removed to Oxford, where a newspaper was published under the name of the *Oxford Gazette*; but after their return to the metropolis it appeared as the *London Gazette*. It is still in existence, and serves as the vehicle for bankruptcy lists, army, navy, and other official notices. Among the most notable newspapers which immediately succeeded the *Diurnal Occurrences*, were the *Mercurius Britannicus*, *Mercurius Pragmaticus*, the *Mercurius Politicus* of Marclmont Needham, and the *Mercurius Aulicus* of John Bickenhead. Meanwhile appeared the first commercial newspaper, the *City Mercury*, published in 1676; the first literary newspaper, the *Mercurius Librarius*, in 1680; the first sporting paper, the *Jockey's Intelligencer*, in 1683; and the first medical paper in 1686.

Daily newspapers had not yet appeared, and their origin may be dated from the eighteenth century. The first London daily, named the *Daily Courant*, was published in 1703, its editor being the well-known Samuel Buckley. At first it consisted of only one page of two columns, five paragraphs of which were translated from foreign journals. Shortly after the appearance of this newspaper Defoe began his famous journal, the *Review*. At first it was published weekly, afterwards twice, and eventually three times a week. Its course, however, was short, extending from February, 1704, till May, 1713. In 1710 the *Examiner* made its appearance, and was followed by the *Whig Examiner*, avowedly intended to censure the writings of others, and to give all persons a rehearing who had suffered under the unjust sentence of the *Examiner*. About the year 1714 the *Gentleman's Magazine* took its rise, and is the only periodical of its class now existing having its origin in that period. In 1726 appeared the first number of the *Craftsman*, which obtained for a time a circulation of nearly 12,000 copies. In 1730 no fewer than 200 half-sheets per month were issued in London alone, besides a number of daily and weekly journals. The aggregate number of copies of newspapers sold in England in 1758 was 7,411,757; in 1760 the number had increased to 9,464,790; and in 1767 to 11,300,980. In the reign of George I. the number of daily newspapers had increased to three, whilst there were others issued three times a week in the evening, besides weekly journals. The leading daily journals of London in the latter part of the eighteenth century were the *Morning Chronicle*, the *Morning Post*, the *Morning Herald*, the *Times*, and the *Morning Advertiser*. The *Times* was founded in the year 1785, and appeared under the name of the *Daily Universal Register*. It was printed and published by John Walter, of Printing House Square, who, in the impression of 1st January, 1788, added to the original name of his journal that of the *Times*. Its circu-

lation at the beginning of this century was only 1000 copies a day; but in 1854, the time of the Crimean War, its circulation had risen to 51,648 copies daily, about double the aggregate of all the other daily journals, which was only 26,268.

Evening papers have been almost as long in existence as daily morning papers, but they did not at first appear every evening. They usually came out three times a week. The names of some of the principal ones were, *General Evening Post*, *London Evening Post*, *Lloyd's Evening Post*, *St. James' Evening Post*, and others. The newspaper press received a great stimulus in the year 1832, when the stamp duty was reduced from 4d. to 1d. The result was that during the first year of the new Act there was an increase of 8,000,000 in the stamps issued, and of sixty-one in the number of newspapers. Fourteen of these were established in London alone. The railway mania produced in London many newspapers devoted to railway matters, their number amounting to about thirty in 1845, but only three of them survived the crisis of 1846. The total abolition of the stamp duty as a tax in 1855, the remission of the duty on advertisements, and the abolition of the tax on paper, gave a powerful impulse to the newspaper press. It made possible the penny newspaper, which has now become so common. Some of these journals have an immense circulation, such as the *Daily Telegraph*, *Standard*, *Daily News*, and the *London Daily Chronicle*, a transformed local journal, first issued in its present form in 1877. Of all the English newspapers, the *Times* continues still to hold the first place, and though its circulation is far below that of the great penny dailies, in the number of its readers it is probably equal to any of them. Everything that is used in the production of the *Times*, except the paper, is made in its offices, and it has supplied the celebrated "Walter machines" to several of the more important newspapers of Great Britain, as well as to the *New York Times*. In the extent and variety of the information collected for its use, and in the literary ability of its contributors, the *Times* is beyond controversy "the leading journal of the world."

The progress of the newspaper in the United Kingdom may be seen from the fact that in 1851 the whole number of journals amounted to 593, of which only eighteen were daily. In 1883 there were established and circulated 1962 papers, of which 180 were issued daily. Since 1875 "newspaper trains" have been run from London, starting sufficiently early to enable the metropolitan daily papers to reach the chief provincial towns by breakfast time.

There are seven evening papers published in London: two Liberal, the *Pall Mall Gazette* and the *Echo*; four Conservative, the *Globe*, *Evening Standard*, *St. James' Gazette*, and the *Evening News*; and one exclusively commercial, the *Shipping and Mercantile Gazette*. The *Echo*, established in 1868, was the first London newspaper to be published at a halfpenny, and its sale rose in a few years to more than that of all the other evening papers combined. Among the more important weekly journals may be mentioned the *Spectator*, founded in 1828, the *Saturday Review* (1855), and the two literary and artistic journals, the *Athenæum* (1828) and the *Academy* (1869). *Lloyd's Weekly Newspaper*, a journal designed for the working classes, which was started in 1842, has now a weekly circulation of over 600,000 copies. *Reynolds's Weekly News paper*, a journal of similar character expressing somewhat advanced opinions, founded in 1850, has also an immense circulation among workmen. Of the weekly illustrated papers the most important are the *Illustrated London News*, which has a circulation of nearly 100,000 copies; the *Graphic*, nearly as important a journal, commenced in 1869; and the *Pictorial World*, which dates from Mareil, 1874. Among the comic papers *Punch*, from the graceful

humour of its illustrations, takes the lead, and its full-page cartoons still continue, as of yore, to satirize with marvellous felicity the more prominent British and European statesmen, while in its smaller drawings it ably reflects the humorous side of contemporary society.

In 1886 the entire number of journals published in England and Wales was 1700, of which 400 were published in London and 150 were daily papers.

Wales.—In Wales there were seventy-five journals published in 1886, three of which were published daily. The earliest existing newspaper in Wales is *The North Wales Chronicle*, published at Bangor, which began to appear in 1807.

Scotland.—The first newspaper actually published in Scotland was the *Mercurius Politicus*, printed at Leith in October, 1654. Though this newspaper was printed in Scotland, it was in reality of English origin, and we do not find a really Scotch name given to any newspaper till 1660, when the *Mercurius Caledonicus* was published in Edinburgh. The names of two very eminent men became afterwards connected with the Scottish press—those of Dugald Stewart and Sir Walter Scott. The relation of the former arose out of the patronage of the Whigs, who, on their accession to office in 1806, created for their adherent a new office called "Printer of the *Edinburgh Gazette*." In 1817 the leading journal of Scotland, the *Scotsman*, made its appearance. As a daily paper it has obtained the reputation of being one of the best in the kingdom, having been conducted with a degree of enterprise, and maintained a literary style, generally associated with the metropolitan papers alone. In 1782 there were only eight newspapers printed in Scotland; in 1792 there were fourteen; in 1809 there were twenty-four; and in 1821, thirty-one. In 1886 the number of journals published in Scotland was 184, of which twenty were published daily.

Ireland.—The history of Irish newspapers has few features of great interest. The papers were formerly very inferior to the English and Scotch journals, but their character and appearance have of late years steadily improved and their number rapidly increased, until in 1883 there were 152 journals published, of which sixteen were issued daily.

Under the Post Office Act of 1870 every newspaper is subject to an annual registration with a fee of five shillings, and without such annual registration a newspaper can pass through the post only at the book rate of postage. By the Newspaper Libel and Registration Act of 1881 (44 & 45 Vict. c. 60) the proprietors and publishers of newspapers are required to make a return to the Newspaper Registry Office on or before the 31st of July in every year, of the title of the newspaper, and the names, occupations, and abode of the proprietors. Non-compliance with this requirement within one month of that date renders the persons responsible liable to a penalty not exceeding £25. Wilful misrepresentation in such a return is punishable by a fine not exceeding £100.

France.—French newspapers date their origin from the publication of the *Mercurie François* (1605–45), a kind of historical compilation. Their more immediate prototype, however, was the *Gazette*, issued by Théophraste Renaudot in 1631, appearing generally once, and for some time twice a week; and in the latter part of its existence, when besides political news it contained advertisements and financial accounts, it appeared daily. In 1650 Paris had its poetical newspaper, in which local gossip and scandal were the subjects chiefly treated. The *Mercurie Galant* appeared in 1672, a species of literary journal attempting to combine the qualities of the gazettes, grave and gay. The *Moniteur*, for many years the official organ, was founded in 1760, and treated of moral and political subjects. For a considerable time the *Moniteur* and the *Mercurie François* were under the management of one

proprietor, M. Panckoucke. The *Moniteur* kept pace with the majority of the Assembly during the revolutionary period, while the *Mercur*e sided with the minority. The sale of the *Mercur*e was very great in the year 1790, amounting to some 13,000 copies. Its ability was undoubted; it was characterized by Mirabeau "as the ablest of newspapers." The only other newspaper which may be taken notice of here, whose date was prior to the Revolution, is the *Journal de Paris*. After dragging a miserable existence, it finished its course at the close of half a century from the date of its birth. Its palmiest days were in 1792, when its circulation is said to have reached 20,000. The first daily political newspaper, the *Journal de Paris, ou Poste du Soir*, was published in 1777, which maintained itself till 1825. The Revolution gave a great impulse to the newspaper press of France. The effect produced by that movement has been thus described by Louis Blanc:—"In the space of a few months France was inundated with printed sheets of every tone and description—weekly, monthly, quarterly; royalist, radical, moderate, and frantic; distilling poison and emitting abuse, disseminating error, encouraging calumny, proclaiming facts, echoing every expression of passionate anger, irradiating every awakening idea." The Restoration did not much improve the condition of the press. The increase of the stamp duty from five to ten centimes caused the price of the leading journals to be raised from seventy-two to eighty francs a year. The newspapers sank into a state of torpor. Mirabeau was among the first to break the spell by his *Lettres à ses Concitoyens*. These were published in 1789. In the same year appeared the *Bulletin des Séances de l'Assemblée Nationale*, the *Journal des États Généraux*, the *Courrier de Versailles*, *Révolutions de Paris*, the *Journal des Débats*, the *Ami du Peuple*, the *Moniteur*, and the *Révolutions de France et de Brabant*. Only two of these are now in existence, the *Moniteur* and the *Débats*. The *Journal des Débats* was founded by Barrère and Louvet, passed in 1800 into the hands of Louis François Bertin, the elder, and has since remained in the hands of the Bertin family. Under Napoleon the *Moniteur* was the only newspaper of a political character which was not looked upon with suspicion. The *Débats* was more of a literary journal, and as such still maintains its celebrity. One of its early contributors was Royer-Collard. Another prominent newspaper during the latter part of the Restoration was the *Globe*. Among its early contributors were Guizot, Cousin, and Jouffroy, and at a somewhat later period Remusat, Girardin, and Carnot. In 1815 a severance among the writers and subscribers of the *Débats* occurred, which led to the foundation of the *Constitutionnel*, whose politics were those of the higher middle class and of the military and civil aristocracy created by Napoleon. It was in constant opposition to the elder Bourbons. For a time its success was very great, and at one period it could boast of 23,000 subscribers at eighty francs a year. Its decline was as rapid as its rise, for when Dr. Véron purchased it the sale had diminished to 3000. Under the editorship of Véron its fortunes were revived, and its circulation was again increased to upwards of 20,000. While the *Constitutionnel* was losing its influence, the *National* was rising to the zenith of its power. Its staff of writers consisted of eminent men, and it was remarkable for the influence it exerted in the overthrow of Charles X. and Louis Philippe.

The cheap journalism of Paris began in 1835, when M. de Girardin founded his famous journal, *La Presse*. Its price was forty francs a year, which was only half the price of the leading newspapers of the period. Within three months of its commencement it obtained a circulation of 10,000 copies, and within the next three months doubled that number. *Le Siècle*, which also reduced its price to forty francs, reached in a few years a circulation

of 30,000 copies. Within three months after the Revolution of 1848 about 400 new journals sprang into existence. The principal organ of the moderate republicans was *Le National*, and of the more radical party *La Réforme*.

According to some returns prepared in 1885 the total number of journals of all kinds published in France was about 2200. The total number of those of a political character was 150, of which forty-nine were published in Paris. Of the latter the more important of the republican journals are *Le Journal des Débats*, *Le Temps*, *Le Siècle*, *Le XIX. Siècle*, *La Paix*, *La Justice*, *Paris*, *La République Française*, and *Le Parlement*. The chief Bonapartist organ is *Le Pays*. The Legitimists and the Church of France support *La Gazette de France*, *Le Monde*, *L'Union*, *La Défense*, *La Civilisation*, *L'Officier*, while the organs of the Orleanist party are *Le Moniteur Universel*, *Le Constitutionnel*, *Le Français*, and *Le Soleil*. The association of prominent politicians with particular newspapers is more openly recognized than in England, and there are several journals which are known on all important questions to be inspired by certain public men. Thus *Le Français* was for many years conducted under the auspices of the Duc de Broglie, *La République Française* was founded in 1871 by Gambetta, and represented his opinions until the time of his death; and at the present day *La Paix* is generally referred to as M. Grévy's paper, and *La Justice* as the organ of M. Clémenceau.

In addition to the political newspapers Paris recently possessed seventy-one religious journals, 104 legal, 153 commercial, 134 technological, ninety-eight scientific and medical, and fifty-nine artistic. Almost all branches of industry and trade have their special organs. In addition to these there are a number of illustrated journals, such as *L'Illustration*, *Le Monde Illustré*, *L'Univers Illustré*, and *Le Journal pour Tous*, which have an aggregate circulation of 150,000. In France newspapers are generally undertaken in shares. The editors and principal writers are more responsible, and more generally known, than in England, which is either a cause or effect of the general prejudice in that country against anonymous writing. Journals are thus more under the control of particular sections of the political world or powerful individuals. Among the provincial journals the most important are those of Lyons, although in some of the other towns there are well-conducted newspapers.

Germany.—The earliest date of a real German newspaper is 1615. Anterior to that date there were periodical publications of news, a copy of one of which bears the date 1495. The *Frankfurter Oberpostans-Zeitung* was the first of the regular series, established by Egenolph Emmel at Frankfurt-on-the-Main, and it was continued until 1866 as the *Frankfurter Postzeitung*. This was followed by newspapers throughout all parts of Germany; and in less than a century every city of importance was in possession of its regular newspaper. The *Hamburgische Correspondent*, founded in 1714, obtained the widest circulation during the middle of the eighteenth century, and was the only newspaper which really obtained its foreign news from "our own correspondent." The *Augsburg Allgemeine Zeitung* appeared at the close of the eighteenth century, and has since obtained the widest circulation in that country. The intention of its founder was to make this the organ of statesmen and publicists, to reach the public through the thinkers, to hold an even balance between the parties of the period, and to furnish a trustworthy source of materials for future historians. The French Revolution called into existence a number of new journals of a purely radical tendency, most of which were suppressed in 1833. One of the ablest journals between that period and the Revolution of 1848 was the *Rheinische Zeitung*, established at Cologne in 1841, and continued until 1850. The events of 1848 called forth a

perfect flood of journals; but these vanished nearly as rapidly as they had appeared. In more recent years the German press has continued steadily improving—greater liberty having been given for the discussion of all kinds of questions—and has every appearance of occupying an influential position in the affairs of that country. It was recently estimated that there were about 3780 newspapers and periodicals regularly published in the German language in Germany Proper, while in other languages there were in Polish, twenty-six; French, seventeen; Danish, ten; Wendish, six; Lithuanian, two; English, two; and Hebrew four. Of these 2451 were political journals, of which 640 were avowedly government or administrative organs. It is, however, an open secret that many of the professedly independent newspapers of Germany are secretly subsidized and inspired by the government, or by the Imperial chancellor, Prince Bismarck. The German papers of the better class give special prominence to foreign affairs, and most of them have daily correspondence from Paris. The political journal which enjoys the largest circulation is the *Volkzeitung*, other important newspapers being the *National Zeitung*, the *Norddeutsche Allgemeine Zeitung*, the *Neues Berliner Tageblatt*, and the *Tribüne*. The official gazette is the *Deutscher Reichsanzeiger*, and the leading humorous paper is the *Kladderadusch*. An important feature in connection with the German press is the prominent position taken by the advocates of socialism, who regularly publish over forty political journals, thirteen of which appear daily. The collective circulation of these journals is said to exceed 130,000.

Austria-Hungary.—In 1840 there were about 100 Austrian periodicals. This number increased during the next six years to 155, of which forty-six were political, but their politics were always those of the government. The press only got freedom of opinion in 1848, since which time there has been a considerable increase both in the number of periodicals and an improvement in their character. At present the ablest paper in Austria is the *Neue Freie Presse*, which appears daily. In 1885 there were eighteen daily newspapers published in Vienna, of which ten ranged in average circulation from 14,000 to 54,000 copies. At present it is not possible to obtain statistics of the number of newspapers published, apart from other journals which should be otherwise designated, but over 1000 journals of all descriptions are published in Austria-Hungary. Of these 600 appear in German, 170 in Hungarian, seventy-nine in Bohemian, fifty-eight in Polish, fifty-six in Italian, twenty-two in Slovenian, eleven in Croatian and Servian, nine in Ruthenian, eight in Roumanian, three in Hebrew. Counting periodicals of all kinds about 480 are published in Vienna, 230 in Buda-Pesth, and 100 in Prague.

Russia.—The origin of Russian journalism is due to Peter the Great, who took personal superintendence of the first newspaper, published at Moscow in 1703, and afterwards in St. Petersburg. These two towns have all along taken the lead in Russian journalism. The newspapers of St. Petersburg may be divided into two classes—those expressing the opinions of the government, the others being independent. Politics are not very often discussed, but instead scientific and literary news fill the columns of their papers. It is only during periods of great importance that the Russian journals are allowed to discuss the doings of the government, and then they are expected to defend it. The *Journal de St. Petersburg* is the organ for foreign affairs. During the Crimean War the widest circulation was obtained by the *Northern Bee*. The *Invalide Russe*, connected to some extent with the establishment for invalid soldiers, has a semi-official character, particularly in military information and statistics. The journals of Finland are published in Swedish; those of Poland and Lithuania in Polish. In Kasan a journal is published in Tartar,

and in Astrakhan one in Kalmuk. Upon the adoption of a more liberal policy by Alexander II. new daily journals arose in St. Petersburg, Moscow, and various other places, which bade fair to make a marked improvement in Russian journalism; but the period of relaxation of censorship only really lasted about ten years, from 1855 to 1864, and since the latter date repressive measures have been freely resorted to. Only a very limited number of foreign journals are allowed to enter Russia, and these are subjected to strict official supervision. In 1880 there were 608 newspapers and journals published in the Russian Empire, 155 being official and administrative organs. Of these 417 were printed in the Russian language, fifty-four in Polish, forty in German, eleven in Lettish, ten in French, seven in Esthonian, three in Lithuanian. The Nihilists have, however, managed for several years to maintain a secret press in Russia, from which from time to time proclamations, appeals, &c., are issued, and they have also printed and circulated several newspapers. Of these the most celebrated has been the *Narodnaia Volia*, the organ of the terrorist party, which obtained quite an extensive circulation in spite of all the efforts of the police to discover its publishers.

Italy.—The earliest Italian newspapers appeared, as before stated, in the sixteenth century, under the name of the *Gazzetta* of Venice. They were in manuscript; and among those found in the Magliabechian Library are some bearing dates of the early part of the sixteenth century; while one printed copy, bearing the date 1570, is found in the British Museum. At first these were only occasional, not periodical; nor can it be known when they were first printed at stated intervals. Until a comparatively recent period the Italian press was subjected to a rigid censorship, and the newspapers were merely official organs possessing little or no influence either for good or ill. Since 1861, however, the press has been comparatively free, and now all the large towns support a number of journals which give unrestrained expression to political opinion. The official Italian returns do not distinguish the newspapers strictly so called from periodicals of other descriptions, but the total number of "periodicals of all kinds" was 1454 in 1882. There were 149 political dailies, thirty-five of which were published in the Roman district, thirty-six in that of Naples and Sicily, and twenty-two in Lombardy. The leading Italian journal in respect to quality is *L'Opinione*, founded in 1847 at Turin, but now published at Rome. Like the London *Times* its circulation is inferior to that of several of its rivals, but from the ability with which it is edited it is one of the first in point of influence. *L'Italia* is the government mouthpiece for foreign affairs, and *La Voce della Verità* represents the opinions of the papacy. The *Gazzetta del Popolo* of Turin was formerly one of the most popular journals, its sale reaching almost to 20,000 copies, but at the present day its subscribers are not more than 8000.

Spain.—Spanish newspapers are of a somewhat recent date, none of them being in existence before the last century. The first regular newspaper was the *Diario de Madrid*, which for some time enjoyed a monopoly of news. Gradually the press rose in importance; and in 1831, when liberty was extended to it, nearly twenty political journals arose in Madrid alone; and in 1844 that number had increased to forty, of which the *Heraldo* had by far the largest circulation. The number of Spanish newspapers is no proper index to their real value, many of them possessing little or no real political weight, being the mere stepping-stones of political adventurers, and there is no country of equal standing in Europe with so few important journals. The total number of newspapers of all sorts published in Spain is about 220, of which fifty-eight appear in Madrid. All Spanish ministries recognize it to be part of their duty to keep a tight rein upon the press,

and they do not hesitate to enforce prompt and severe measures of repression in periods of popular excitement. Thus in 1885, when complications were threatened with Germany, the government at once stopped the circulation of most of the newspapers between Madrid and the provinces, suppressed, detained, or altered all foreign or internal telegrams between the different journals, and instituted thirty-nine press prosecutions in five days.

Portugal.—In Portugal the newspaper press is at a very low ebb. The organ of the government is the *Diário do Governo*, in addition to which there are five daily political newspapers published in Lisbon, with three in Oporto. There are about 180 journals of all kinds and of various periodicity published in Portugal, of which sixty-eight appear in Lisbon.

Belgium and Holland.—Belgium takes rank before the other continental countries in respect of the first publication of newspapers. It is stated that the *Nieuwe Tydinghen* of Antwerp was published in 1605, but as no copy of any number of this paper appears prior to 1619, the statement rests upon a somewhat doubtful footing. Binges had its newspaper as early as 1637, but the precise date of its foundation is unknown. The first newspaper published at Ghent was in 1667. At the present day some influential papers are published in Belgium, including the *Indépendance Belge*, the leading liberal journal; *L'Étoile Belge*, the organ of the clericals, which has the largest circulation of any Belgian newspaper; the official *Echo du Parlement*; and *Le Nord*, a paper sustained by the Russian government. The newspapers of Holland have always had more weight in the commercial than in the political world. The most esteemed are *Het Nieuws van den Dag*, and the *Allgemeen Handelsblad*, both daily papers published at Amsterdam; the *Haarlemsche Courant*; and the *Nederlandsche Staats-Courant* and *Dagblad van Zuidholland*, both printed at the Hague.

Denmark.—Danish journalism is a thing of recent origin. The oldest existing newspaper is the *Berlingske Tidende*, established in 1749, and at first published in German. The *Fædrelandet* is the popular journal among the people. Until the year 1830 there were only two newspapers published in Copenhagen, the columns of which were for the most part filled with extracts from foreign journals. The year 1834 is the period from which Danish journalism really became flourishing. In 1849 the total number of newspapers amounted to thirty-six, from which time it has gradually increased, until at the present day it reaches about 140.

Iceland has ten newspapers and two magazines, two of the newspapers being printed in Copenhagen.

Sweden and Norway.—The earliest regular Swedish newspaper seems to have been the *Ordinarie Post-Tidende*, founded in 1643, and continued till 1680. It was followed by the *Swensk Mercurius* in 1675, and the *Relationes Curiosæ*, in Latin, in 1682. The *Gazette Française de Stockholm*, founded in 1742, and the *Mercur de Suède*, in 1772, were published in French. It was not until 1820 that the Swedish press became politically important, when the *Argus* was established by Johansson. For a long time the organ of the royalists (the *Fäderneslandet*) and that of the reformers (the *Aftonbladet*) were the two most important journals in Sweden. In 1801 there were twenty-five newspapers, and in 1885 the newspapers and other journals numbered over 300.

The oldest Norwegian paper is the *Christiania Intellectuelleder*, established in 1763. The next paper, the *Adressecontoirs Efterretninger*, was published in Bergen. The *Constitutionelle* is the government organ; the *Morgenblad*, founded in 1819, that of the popular party.

Switzerland.—In proportion to its size Switzerland has a wonderfully active press, and in 1885 it possessed 850 political and general newspapers. Fifty-three of these

were of daily issue, 166 appeared twice or thrice a week, and seven only were of weekly issue. Of the political journals the great majority are classed as "progressist." The aggregate average circulation of the Swiss newspapers is estimated to be over 600,000 copies.

Turkey.—The first Turkish journal appeared in 1795, published at Pera by a Frenchman, M. Vermihac. In 1825 Alexandre Blaquet founded the *Spectateur d'Orient* at Smyrna, which had a great influence during the Greek revolution. The most important Turkish journal, the *Djerridei Haadis*, was published in 1843 by an Englishman born in Turkey, Alfred Churchill. There are now about 120 newspapers and journals published in the Turkish dominions, Asiatic and European, and the languages include Turkish, Arabic, Armenian, Greek, English, French, and several others.

Greece.—Greek journalism dates its rise from the establishment of Greek independence. Previous to that a few Greek newspapers appeared in Paris and Vienna. Athens is undoubtedly the centre of Greek journalism, and can boast of a few good papers. There are twelve political newspapers published at Athens and three in the Ionian Islands. In 1885 ninety periodicals were published in Greece, of which fifty-two were issued at Athens.

Asia.—In the British possessions in Asia there are a number of newspapers, printed for the most part in the native languages. The first Anglo-Indian newspaper was published at Calcutta in 1781, and in the year 1781 another newspaper, the *Calcutta Gazette*, followed it. Prior to Lord Wellesley's administration in India, the principal newspapers were the *World*, the *Bengal Journal*, the *Hurkaru*, the *Telegraph*, the *Asiatic Mirror*, the *Calcutta Courier*, the *Indian Gazette*, and the *Calcutta Gazette*. At first there was no direct censorship of the press, but punishment was inflicted on writers for offensive articles. Mr. Duane was banished to Europe in 1794 for publishing "an inflammatory address to the army" in the *World*. Four years afterward a similar punishment was inflicted on Mr. Maclean for animadverting on the official conduct of a local magistrate in the *Telegraph*. In 1799 Lord Wellesley established a censorship, which was abolished by the Marquis of Hastings in 1818, but a license was substituted instead. It was under the marquis that the native press was first commenced, and in 1832 there were five native and six European journals. The licensing of the press was done away with by Sir Charles Metcalfe in 1835, and the press remained free down to the Sepoy mutiny, at which time the system of licenses was returned to.

By the Act of 1878 for the regulation of the vernacular press of India, it is affirmed that "Printers or publishers of journals in Oriental languages must, upon demand by the due officer, give bond not to print or publish in such newspapers anything likely to excite feelings of disaffection to the government, or antipathy between persons of different castes or religions, or for purposes of extortion. Notification of warning is to be made in the official gazette if these regulations be infringed (whether there be bond or not); on repetition, a warrant is to issue for seizure of plant, &c.; if a deposit has been made forfeiture is to ensue." In cases where the proofs are submitted to a government officer before publication a deposit is not exacted. Of newspapers and journals of all kinds published in India in 1885, out of a total number of 400 sixty were issued at Bombay and fifty in Calcutta.

In China the official newspaper is the *Peking Gazette*, printed from movable wooden types, and circulated among the officers of state throughout the empire. It is devoted to the imperial decrees, the memorials from officers of state, with the official notices or answers in reply, and a sort of court circular styled the "Copy of the Palace Gate." Since 1858 several newspapers on the European model have been established in the treaty ports open to foreigners, and in 1882

there were twenty-two periodicals issued in China, twelve being in Chinese, nine in English, and one in French. Fourteen of these appear at Hong-Kong, and the only purely Chinese town which produces anything of the kind is Hankow. The Chinese newspapers have a very limited circulation, and as a rule it may be said that a newspaper is a thing unknown to the 400,000,000 inhabitants of the Celestial Empire.

A striking contrast to the immobility and indifference of the Chinese is afforded by the neighbouring empire of Japan, where newspapers to the number of 250 are produced by the native press and circulate freely among the masses. In all the principal native cities newspaper shops are established, and they are invariably crowded with eager purchasers, thirsting for the latest news of all sorts.

America.—The first newspaper in the United States was published in 1690, but of this only one number appeared. The only copy of it is preserved in the State Paper Office, London. Afterwards the *Boston News Letter* was founded by John Campbell, a bookseller and postmaster in Boston. This newspaper was published on the 24th of April, 1704, and ended its short-lived existence in 1724. In 1719 a rival had been established, called the *Boston Gazette*, "published by authority." In 1721 James Franklin, brother of Benjamin, started at Boston the *New England Courant*. It differed from its two predecessors in being framed after the model of the *Tatler* and *Guardian*, both in high repute when Franklin was in London. Franklin's staff of writers handled the clergy very unceremoniously, and probably from this circumstance arose, in 1727, the *New England Journal*, avowedly in the cause of Whitfield and Edwards. In 1731 there appeared in the same city the *Weekly Rehearsal*, edited by Jeremy Grindley. In 1748 a number of young men, headed by Samuel Adams, set up the *Independent Advertiser*, a freethinking and free-speaking journal, which went in avowed opposition to the governor. Names might be multiplied, but the progress of the newspaper press was for a long time very slow. There were fifteen unsuccessful attempts between the years 1740 and 1770 to establish newspapers in New York. In 1720 there were only seven newspapers published in America; in 1740 the number had increased to fourteen, five of which belonged to Boston. The struggles for independency gave a new character to the American press. One of the most violent and daring newspapers of this class was the *Massachusetts Spy*, which began in 1771 to advocate recourse to arms. For a time it was removed from Boston to Worcester, was suspended two years, was eventually resumed, and has continued its existence since. At the revolution there were thirteen papers in the New England colonies, eight in Pennsylvania, three in New York, and ten in the middle and southern colonies. None of these were published oftener than once a week. In 1861 there were 450 daily newspapers in the United States, of which about three-quarters were in the non-slaveholding states. According to the official returns for 1880 the total number of the daily newspapers published in the United States was 971, with an aggregate circulation of 3,566,395, the number of other periodicals being 10,343, and the united annual circulation 31,779,686. In the state of New York alone there were 115 daily newspapers and 1296 periodicals, the united annual circulation being 9,374,134 copies. Of the newspapers of the United States the *New York Herald*, founded in 1835, has by far the largest circulation. It is published at two cents, but its proprietor derives an immense revenue from its advertisements, of which nearly 4000, filling 100 columns of the paper, have appeared in a single number. The *New York Tribune*, established in 1841 by Horace Greeley, comes next in the extent of its circulation, and it is also issued as a weekly journal. The other dailies which enjoy a large circulation are the *New York World*, *The Sun*, *The World*, and *The Evening*

Post. There is also one daily illustrated paper published in America, the *Daily Graphic* of New York. The American journalists display an immense amount of energy in collecting news, and they use the telegraph to a much greater extent than even the most enterprising of their English contemporaries. The *New York Ledger* and *Harper's Weekly* have each an enormous weekly circulation. Of the 12,000 newspapers and periodicals published in the United States in 1886, nearly 11,000 were in English, 650 in German, fifty in Danish and Scandinavian, forty in French, and twenty-six in Spanish.

In British North America in 1886 there were nearly seventy daily papers, with an aggregate circulation of each issue of about 250,000, the total number of journals of all kinds being 630.

Australia, New Zealand, &c.—The first newspaper in Australia was the *Sydney Gazette* and *New South Wales Advertiser*, founded by George Rowe in 1803. A great number exist in the various towns, of which the principal are—at Melbourne the *Age*, with a circulation of about 44,000, the *Argus*, and the *Herald*; at Sydney the *Evening News*, 35,000, the *Australian Town and Country Journal*, 30,000, and the *Bulletin*, 20,000. In Tasmania three daily newspapers are published in the capital, but they have only a small circulation. In New Zealand the chief newspaper is the *New Zealand Times*, with a circulation of about 7000. In Cape Colony the chief papers are the *Evening Express* and the *Cape Argus*, having a circulation of 6000 and 5000 respectively.

According to the valuable *Newspaper Directory of the World*, published by Henry Hubbard (New Haven, Connecticut), the daily newspapers of the world in 1885 numbered 4100. Of these Europe had 2400, North America 1200, South America 210, Asia 151, Australasia ninety-four, and Africa twenty-five.

Newspapers now form one of the most important features in the social economy of the people, and are particularly powerful as great political engines. In general, they are remarkable for the great amount and variety of the matter they contain, the rapidity with which they are printed and circulated, and the accuracy and copiousness of their reports of public meetings and debates in Parliament. In the course of the last fifty years their most important advance, perhaps, has been in the sincerity of their writers. The gradual entrance into the ranks of their contributors of a number of highly-cultivated men, who have brought with them the self-respect of gentlemen, has gone far to diminish one of the most scandalous abuses of the old system, under which clever but unscrupulous men were always ready to write on either side of any question.

NEWT or EFT (*Triton*) is a genus of amphibians belonging to the family Salamandridæ and order URODELA. The Great Water Newt (*Triton cristatus*) is one of the most common, and the largest of all the British species. The body is about 6 inches long, thick, round, and corrugated, and the skin is thick and covered with small warts or tubercles; the head is flattened. The tail is about two-fifths of the entire length, considerably compressed, and keeled on both upper and under edges. In the breeding season a crest appears on the back of the male, running the whole length, and separated from the corresponding crest of the tail by a notch at the loins. The upper parts are of a blackish or yellowish-brown, with black round spots, while the under surface is of a bright orange, with round black spots; the sides are dotted with white, and, in the male more especially, the sides of the tail are of a beautiful shiny pearly white. The Great Water Newt is a native of ponds and large ditches in many parts of England, and is also found in several places on the Continent. It lives chiefly upon aquatic insects. In spring a great part of its food consists of the tadpoles of the common frog, of which it appears to be very fond; and, according

to Professor Bell, it devours also the smaller or smooth newt. These newts are seldom found out of water, and in winter they commonly remain torpid at the bottom of ponds and ditches. They swim principally by means of the tail, the short limbs being turned backward so as to offer the least amount of resistance. The skin is shed at intervals, coming off in shreds. The female deposits her eggs on the leaves of aquatic plants, placing a single egg in each leaf, which she folds together by means of her hind feet. Like other members of the family Salamandridæ, the newts possess, to a wonderful extent, the power of repairing mutilations.

The Smooth Newt (*Triton* or *Lissotriton punctatus*) is another common species in this country. It is considerably smaller than the preceding, being less than 4 inches in length, and has the skin quite smooth. It also differs from the above species by wanting the glandular pores along the sides of the body. The colours vary considerably at different periods of the year and in the two sexes. The male is usually of a brownish-gray above, passing into yellow beneath, which in spring becomes a rich, bright orange, and is everywhere marked with round dark spots of unequal size. The crest in spring is often tipped with bright red or violet. The female is commonly of a light yellowish-brown, or even buff, with scattered brown dots. The flat, compressed tail terminates in a sharp point, and the crest of the back and tail are continuous. The smooth newt is oftener seen on land than the great water newt. It feeds on insects, worms, &c., and is preyed on by several kinds of fish. Several other species of newts are found in Britain.

NEWTON, SIR ISAAC, was born 25th December, 1642, old style, at Woolsthorpe, near Grantham. From the pedigree registered upon oath in the Heralds' Office, by Newton himself, in the year 1705, it appears that his family was resident at Westby in Lincolnshire until it became possessed of the manor of Woolsthorpe. His mother was left a widow during her pregnancy, and appears to have given premature birth to her child, which was of extremely diminutive size. Mrs. Newton soon contracted a second marriage with the Rev. Barnabas Smith, rector of North Witham, whereupon her son, then about three years old, was confided to the care of his maternal grandmother, by whom he was sent to a day-school, and afterwards to the free grammar-school of Grantham, where he evinced considerable aptitude for mechanical contrivances. The death of Mrs. Newton's second husband, in 1656, induced her to return to Woolsthorpe, and in that year Isaac was taken from school to assist in the management of the farm. Accordingly, on market days he was sent to Grantham, accompanied by an aged domestic, either to dispose of farm produce, or to purchase such things as were needed by the family. But on these occasions it more frequently happened that Isaac stopped by the wayside, watching the motions of a water-wheel or some other piece of machinery, or if he reached the town of Grantham it was only to resort to the apothecary's garret in which he had resided while he attended the grammar-school, and where a few old books afforded him ample entertainment until his trusty companion summoned him to return home. These and other instances having shown the inutility of thwarting his studious disposition, he was again despatched to Grantham school. When he had attained his seventeenth year it was determined to send him to Cambridge. His matriculation took place 5th June, 1660.

During the first six years of his residence at Trinity College, that is, before the completion of his twenty-fourth year, he invented his binomial theorem, established the fundamental principles of his doctrine of fluxions, and demonstrated the law of the force in virtue of which the planets gravitate towards the sun, although, in consequence of the erroneous measurement of the earth then in use, it

was not till afterwards that he was able to show that the same law holds with respect to the moon, and that the force manifested at the earth's surface in the fall of a pebble is identical, as to its nature, with that which pervades the whole planetary system.

Wallis had suggested a method of obtaining the approximate quadrature of the circle, the practicability of which depended upon an interpolation. Newton set about effecting this, notwithstanding the discouraging declaration of Wallis, that he believed it to be impracticable. The attempt, however, led (1663-64) to a discovery of greater moment, the *Binomial Theorem*. This theorem, combined with the previous labours of Wallis and others, supplied Newton with a method of making his other researches effectual in determining the area and rectification of curves, the surface and content of the solids formed by their revolution, and the position of their centre of gravity, and in solving other problems. The fluxionary calculus was invented by Newton in or before the year 1665, "when he took his degree of B.A."

The raging of the plague in 1665-66 induced Newton to quit Cambridge and retire to Woolsthorpe. Here it was that he began to reflect more particularly upon the nature of the force by which bodies at the earth's surface are drawn towards its centre, and to conjecture that the same force might possibly extend to the moon, and there be of sufficient intensity to counteract the centrifugal force of that satellite, and thereby retain it in its orbit about the earth. To compare this hypothesis with observation, it was necessary to determine the law according to which the intensity of such a force would vary with the distance from the earth's centre; for although no sensible variation can be detected within the narrow limits of direct observation, namely, the summit of the highest mountains, or the bottom of the deepest mines, it was reasonable to presume that some variation would be appreciable at the distance of the moon, and in such case only could the force be just sufficient to counteract the centrifugal tendency of the revolving satellite. To a mind so habituated to generalize, it was a natural extension of his hypothesis to suppose that the same kind of force which incessantly deflects the moon from a rectilinear path might likewise act upon the planets so as to retain them in their orbits about the sun. Now the assumption of an attractive force emanating from the sun was at this time far from being a novelty, and it had even been asserted by Bouillaud that if such a force really existed, its intensity would vary inversely as the square of the distance from the attracting body; but neither Bouillaud nor those who entertained similar opinions had given any proof, either empirically or otherwise, of what they had asserted; and certainly none appear to have attempted to establish that the forces which retain the planets in their orbits were identical, as to their nature, with that which draws a stone, when let fall, to the surface of the earth. Newton showed that the law of the inverse square of the distance is that which really exists in nature; and further, that this law was a necessary consequence of the analogy already discovered by Kepler between the periodic times and the mean distances of the planets. The length of the earth's radius, which entered as a necessary element into the verification, was at that time very imperfectly known; the consequence of which was, that the result of his calculation indicated a force at the distance of the moon greater, by nearly one-sixth, than that deduced from direct observation. This difference, which many would have considered sufficiently small to establish the correctness of the hypothesis, was regarded by Newton rather as a direct refutation of its truth. In 1666, the plague having subsided, he returned to Cambridge. He took his degree of M.A. in 1667; in 1668 he became senior fellow of Trinity, and in 1669 succeeded Dr. Barrow as Lucasian Professor of Mathematics.

The discarded hypothesis having lain dormant for sixteen years, in 1679 he repeated the trial with Picard's value of a degree; but in the course of the work, observing that the conclusion he had formerly anticipated was about to be realized, his ardour is said to have brought on a state of excitement and nervous irritability which precluded his further progress, so that the completion of the calculation was confided to a friend. See GRAVITATION.

In the year 1666 we learn that Newton, in common with many other philosophers at that time, occupied himself in the attempt to grind object-glasses in conformity with the precepts of Descartes and Gregory, and while thus occupied he seems to have conjectured that the defects of refracting telescopes might arise from some other cause than that which had hitherto been exclusively assigned. Either this conjecture or accident led him to consider the phenomenon of the prismatic spectrum, which was then well known to philosophers, although it had been explained by none. In doing so, he remarked that the angle subtended at the aperture of his shutter by the length of the spectrum was considerably greater than that subtended by the sun's diameter, though, according to the received law of refraction, these angles ought to have been sensibly equal. After modifying the experiment in various ways, and assuring himself that this discrepancy did not arise from any irregularity in his prism, the thought fortunately suggested itself of trying the separate effect of the prism upon each of the coloured lights of the spectrum. Accordingly, having transmitted them successively through a second prism at the same angle of incidence, he found—(1) that the colour was in no degree affected by this second refraction; (2) that the spectrum formed by each colour occupied a distinct position on the screen, so that the deviation from the direction of the primitive ray was different in all, being greatest in the violet and least in the red. He therefore came to the important conclusion "that light was not homogeneous, but composed of rays, some of which were more refrangible than others." This discovery must have been made subsequent to the publication of Wallis's "Optical Lectures," which appeared in 1669, for otherwise it is improbable that Newton, to whom the revival of the MS. was confided, and who receives the author's acknowledgments for having "corrected several oversights, and made some important corrections," would have permitted his friend to promulgate views so erroneous.

Although Newton had been thus successful in his optical inquiries, and had detected the principal source of indistinctness in refracting telescopes, he not only did not see how this indistinctness might be removed, but even designated all attempts as desperate; and the long interval which elapsed before the discovery of the achromatic telescope may be attributed to the unmerited reliance which in this instance was placed on his decision. By this opinion he was induced to forego all attempts to perfect the refracting telescope, and directed his attention to the construction of reflecting telescopes on the principles pointed out by James Gregory.

In 1672 Newton was elected member of the Royal Society. In 1675 he received a dispensation from Charles II. to continue in his fellowship without taking orders. In 1687 he was appointed one of the delegates to defend the privileges of the University of Cambridge against the attacks of James II. In 1688 he took his seat in Parliament (or rather in the Convention) as one of the representatives of the university. He was returned to Parliament in 1689 and in 1701, but lost his election in 1705. On no occasion does he appear to have taken any part in the debates of the House. Prior to the year 1694, when he was appointed warden of the mint, with a salary of from £500 to £600 per annum, his pecuniary circumstances are said to have been rather straitened. Four years after receiving the appointment of warden of the mint he was

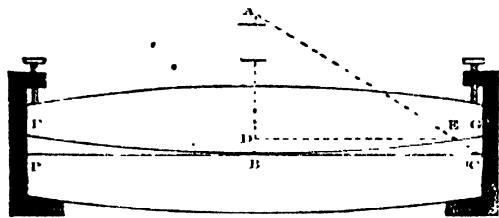
promoted to the mastership of that establishment, with a salary of from £1200 to £1500, and at his death his personal estate was valued at £32 000.

In 1694 we find Newton actively occupied in testing his lunar theory by the observations of Flamsteed, with whom he had hitherto been on the most intimate terms. The quarrel which subsequently took place between Newton and the astronomer-royal is noticed under FLAMSTEED. For the dispute between the partisans of Newton and Leibnitz as to the discovery of the *Differential Calculus* see FLUXIONS. In 1699 Newton was chosen foreign associate of the Royal Academy of Sciences at Paris; in 1703 he was elected president of the Royal Society, to which office he was annually re-elected till his death; and in 1705 he was knighted by Queen Anne. In 1722 he became subject to a disorder of the bladder, accompanied with cough and gout. He presided for the last time at the Royal Society on the 28th of February, 1726-27, and died at Kensington on the 20th of March following, in the eighty-fifth year of his age. His body was interred in Westminster Abbey. In 1731 a magnificent monument, designed by Kent and sculptured by Rysbrack, was erected in the abbey at the expense of his relatives. It bears an appropriate inscription, ending with "*Sibi gratulentur mortales tale tantumque existitisse humanis generis decus.*"

In his person Newton was short, but well set, and inclined to corpulence. His hair, when he was old, was abundant and white as silver. His eye was bright and penetrating till within the last twenty years of his life; but his countenance, though thoughtful, seldom excited much expectation in those to whom he was unknown. In his conversation there appears to have been little either very remarkable or agreeable; but we have the testimony of Dr. Pemberton that "neither his age nor his universal reputation had rendered him stiff in opinion, or in any degree elated. Ascribing whatever he had accomplished to the effect of patient and continuous thought rather than to any peculiar genius with which nature had endowed him, he looked upon himself and his labours in a very different light from that in which both he and they were regarded by mankind. 'I know not,' he remarked a short time before his death, 'what I may appear to the world, but to myself I seem to have been only like a boy playing on the sea-shore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me'" (Turner's "Collections relative to the Town of Grantham"). But while he thus contrasted the littleness of human knowledge with the extent of human ignorance, he was fully conscious of the importance of his own labours when compared with those of his predecessors and contemporaries, and evinced a natural readiness to assert and vindicate his rights whenever occasion might require. It were to be wished that, by an earlier publication of his discoveries, he had adopted the most eligible mode of establishing the undoubted priority of his claim. Such a course, by changing the current of events, would have left him less open to the charge of having disregarded the claims of others, or of having suffered their reputations to be prejudiced by his silent acquiescence in the acts of his colleagues.

NEWTON'S RINGS are a variety of the *colours of thin films*, prismatic colours due to the clashing of the waves of light reflected from two surfaces of a film, so that mutual interference is produced; some of the colours of white light are absorbed, and the balance shows as a band of colour to the observer. [See INTERFERENCE.] Newton's experiment was made with a plane surface (that of a plano-convex lens, $r = \infty$, of 14 feet convexity), upon which was pressed firmly down by clamping screws a double convex lens, $r = r_1$, with a radius of 50 feet. Thus a thin film of air was inclosed between the lenses, varying

from nothing at the point of contact, *n*, to an appreciable distance at the margins. It was found that at *n* was a black spot, that round this was a pale blue ring, round that a white ring, then yellow, orange, deep red. Following these the concentric rings occur in another series, the colours of the rainbow—violet, indigo, blue, greenish-white, yellow orange, bright red, crimson. Then follows another series like the second, but fainter and narrower as they



recede, till near the margins no colour is to be seen. To get an idea of the calculation of the thickness of the film of air at different distances from the central dark spot let the accompanying diagram be observed. *A* lies 100 feet up from *n* along the line *n* to *A*; that is, it lies on the opposite circumference of the circle of 50 feet radius, of which the surface of the lens, *FBC*, forms a part. To save space the diagram is not carried out. From *A* draw *AEC* through any point, *E*, of the curve. It is required to find the thickness of *EC*. From *E* drop *ED*, a perpendicular on *AD*. Then, by the properties of right-angled triangles (*AEC* being a right-angled triangle by Euclid III. 31) $AD : DE :: DE : DN$. Suppose $DE = \frac{1}{4}$ inch. Then we have 100 feet : $\frac{1}{4}$ inch :: $\frac{1}{4}$ inch : $10^{\frac{1}{20}}$ inch, which is the thickness at the point supposed. This is the way in which Newton showed that the thickness of a soap bubble, just as it turns black, must be less than $\cdot 00000075$ inch.

If the Newton's rings are formed in monochromatic light instead of white light, then they show as bands of red and black alternately, or of yellow and black alternately, &c., according to whether the light is red or yellow, &c. With red light the rings are largest, with orange smaller, with yellow smaller still; and so on, through green, blue, indigo, and violet, the rings gradually contracting as the light employed becomes more refrangible.

If the observation is made with transmitted instead of reflected light, the central spot, *n*, is white, and the coloured rings have colours complementary to those of the rings due to reflected light.

NEWTON-ABBOT, and **NEWTON-BUSHELL**, separated only by the Lemon, a narrow brook which flows into the Teign, may be considered as forming one town, a short distance from the south bank of the Teign, 15 miles S. by W. from Exeter, and 214 from London by the Great Western Railway. The towns are beautifully situated in a valley, and are increasing in favour as health resorts. There is a well-attended weekly market, and a good trade in coal, slate, and timber; a large tannery, brewery, railway engine works, and an iron foundry. From Wolborough, in the vicinity, large quantities of potter's clay are sent to Staffordshire. There are a market-hall, two parks, a nunnery, two churches, and places of worship for all denominations of dissenters. William of Orange, after landing at Torbay, in 1688, made his first public declaration here. A short distance from the town, on the Torquay road, is the ancient seat of the Reynells, which received Charles I. in 1625 and William of Orange in 1688. It was once the property of Waller, the Parliamentary general.

NEWTON-IN-MACKERFIELD, a town of England in the county of Lancaster, pleasantly situated, 188 miles from London, and half-way between Liverpool and Man-

chester, was an ancient parliamentary borough, disfranchised by the Reform Act of 1832. Many new buildings have been built of late years, and there is a town-hall, a mechanics institute, and a reformatory farm. The old town consists chiefly of one street, and has an ancient court-house now used for a school. At Newton are the London and North-western Railway Company's works for the manufacture of railway trucks. These, with an iron foundry, sugar refinery, paper mills, a large printing establishment, and coal mines, afford employment for very large numbers. The population in 1881 was 10,580. The town was formerly noted for cock-fighting.

NEWTOWNARDS, a town of Ireland, in the county of Down, situated near the north extremity of Strangford Lough, 13½ miles E. from Belfast, with which it is connected by railway. It is a very neat, well-arranged, and well-built town. The chief manufactures are muslin weaving and flax spinning, and numerous females are employed in embroidery. There is also a large hem-stitching factory. The town has an extensive retail trade. There is a small court-house, a market, a town-hall, a handsome church, and several places of worship for other denominations, chiefly Presbyterian. In the neighbourhood is a square tower, 135 feet in height, erected in 1858 to the memory of the Earl of Londonderry, to whose family the town chiefly belongs. The population in 1881 was 8676. Newtownards is very ancient, and there are some ruins of an ancient church. The Society of Friends first established a linen factory in the last century.

NEY, MICHEL, Prince of the Moskowa, Duke of Elchingen, and Marshal of France, was born at Saarlouis in Lorraine, 10th January, 1769. He enlisted in 1787 in a regiment of hussars, became a lieutenant in 1793, and a captain the year following. He attracted the notice of General Kléber, and distinguished himself on various occasions throughout the war. At the peace of Lunéville he went to Paris, where he was received with distinction by Bonaparte. In 1803 he was appointed minister-plenipotentiary of the French Republic in Switzerland. On his return to Paris, the command of a division of the army encamped near Boulogne was given him, and in 1804 he was raised to the dignity of a marshal. On the renewal of hostilities with Germany in 1805 the direction of the eighth corps of the army was confided to Marshal Ney. A brilliant achievement in this campaign—the capture by storm of the village of Elchingen, 4th October, 1805—obtained for him the rank and title of Duke of Elchingen. It was during the Prussian campaign of 1806 that Ney's military reputation rose to its greatest height. In September, 1808, he was appointed to a command of the army in the Spanish peninsula, and distinguished himself in the various engagements which led to the temporary subjugation of Galicia and the Asturias. In Portugal, though the command-in-chief was held by Marshal Masséna, the merit of the capture of Ciudad-Rodrigo (10th July, 1810) and of Almeida (27th August, 1810) has generally been attributed to Ney. The different dispositions, however, of these two great generals soon brought on divergences of opinion, which ended in a serious dispute, and Ney was recalled.

In 1812 he joined the disastrous expedition to Russia, and had the command of the third corps of the grand army. At the taking of Smolensko (17th August, 1812), at the combat of Valencia (19th August), and, above all, at the sanguinary battle of the Moskowa (14th September), from which he derived his title of Prince of the Moskowa, he eminently proved himself worthy of the surname by which he was known to the army, of "Bravest of the Brave."

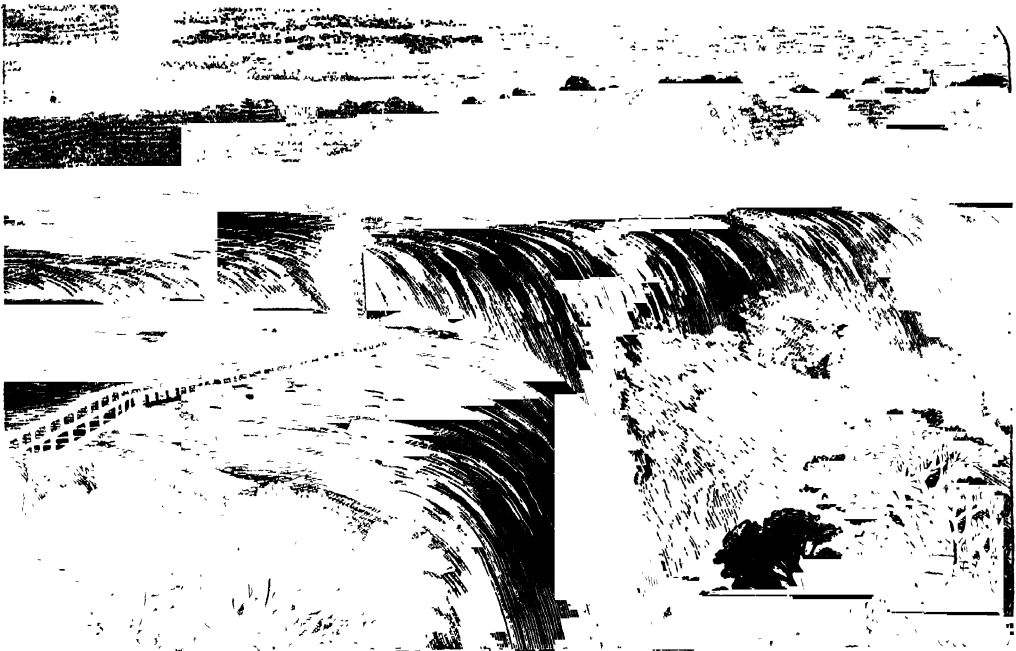
In the campaign of 1813 Ney displayed his usual courage and ability, and was instrumental in obtaining the victories of Bautzen, Lützen, and Dresden; but was him-

self defeated at Dannewitz (6th September, 1813) by the Prussians and Swedes under Bernadotte. After the abdication of Napoleon, in 1814, he withdrew from public life and retired to his country seat. But on the return of Napoleon from Elba, although now a member of the peerage of Louis XVIII., and holding a high military command under him, an earnest appeal from his ancient chief completely overcame the loyalty of the marshal; and his defection was speedily followed by that of his whole army. After the defeat of Napoleon at Waterloo, in which battle Ney behaved with even more than his accustomed gallantry and skill, he returned to Paris, and remained there after the capitulation of that city to the allies. On 24th July, 1815, however, he was placed on a list of proscribed persons. He endeavoured to leave France, but was arrested, 5th August, at the château of Bessons, near Aurillac. He was tried by the Chamber of Peers, condemned to death, and shot on 7th December, 1815, in the garden of the Luxembourg. He met his fate in the most calm and courageous manner. During his trial his defence was rested on the twelfth article of the capitulation of Paris; but this plea was rejected by the peers. Opinions are divided on this matter; but an unprejudiced judgment must now admit that the execution of Ney was an unworthy act of

vengeance, and that it was one of the most signal blunders which the Bourbons committed. His Memoirs were published by his sons in 1833.

NGAMI ("the waters"), the only collection of fresh water in South Africa which can be called a lake, is situated in lat. $20^{\circ} 40' S.$, and lon. $25^{\circ} E.$, 3713 feet above the sea level. It seems to vary in size according to the rainfall, but the generally received opinion is that it is gradually drying up. At the period of its discovery it was about 50 miles in length, by an average width of 8 or 10. It is now about 50 by 7. It receives at its north-western extremity the waters of the Tonku River, supposed to be an anastomosing branch of the Zambesi, rising far to the north-west, near the heads of the Cuanene River. On the eastern extremity of the lake issues a similar stream, called the Zonga, which is also connected with the Zambesi. A remarkable feature about these streams is that they often appear to flow in opposite directions, *i.e.* in and out of the lake. Crocodiles are abundant. The lake was first visited by Dr. Livingstone in 1849, and more thoroughly explored by Andersson in 1853, and by F. Green in 1855.

NIAGARA RIVER AND FALLS. The Niagara River is the connecting link between Lakes Erie and Ontario, separating British North America from the United



Horse-shoe Fall, Niagara.

States; it has a course of 34 miles, and a width at its point of issue from Lake Erie of about a mile. Six miles lower it divides into two arms, which embrace Grand Island, 7 miles long by 2 to 5 broad. In this part it runs along a table-land 330 feet above Lake Ontario; the banks are about 20 to 30 feet high, and the current gentle. Nearly 8 miles below the island rapids begin, having a fall of 57 feet in three-fourths of a mile; these terminate in the celebrated Falls of Niagara. The broad river is precipitated over a ledge of rocks, and formed into two cataracts

by the intermediate Goat Island. The Horse-shoe Fall, so called from its former curvilinear shape, now worn somewhat angular, on the Canadian side, is by far the most effective, being the broadest, above 600 yards wide, though with a slightly inferior height to the other branch. The respective descents are about 154 and 162 feet. Miles away from the spectacle the boom of the waters is heard and the spray seen, which led the Indians of the olden time to give the name *O-ni-aw-ga-rah*, the "Thunder of Waters," to these wonderful falls. Leaving the base of the

falls, the river rushes on with great velocity for 7 miles down the sloping bottom of a rocky ravine 200 to 350 feet deep, and having perpendicular sides, the width from cliff to cliff being 250 to 400 yards. This ravine has been excavated by the river in the above-mentioned table-land, which terminates suddenly at Queenstown in a steep escarpment or inland cliff facing north towards Lake Ontario. Here, it is supposed, the falls originally commenced in early times. Two miles below the falls, the river is spanned by a railway suspension bridge, 800 feet long, 230 feet above the water, and having two floors, one for trains and another for waggons. The east end commands a magnificent view of the falls and rapids. There is also another suspension bridge, 700 feet below, nearly one-fourth of a mile in length, from which and from the towers at either end a magnificent view of the falls and the ravine is obtained. See also CANADA.

NIBELUNGEN-LIED. The "Lay of the Nibelungs," or more strictly the "Need (Fate) of the Nibelungs" (*Nibelungen-Noth*), is the title of a fine Teutonic epic of unknown authorship, the earliest copies of which date from the thirteenth century, and which was probably about that time compiled from old ballads and traditions, and thrown into the form in which we now have it. The Swiss professor, Bodmer, in 1757, first published to modern times this famous old poem; but he only possessed the second part, "Chriemhild's Vengeance," which is told in twenty lays (or *Aventiuren*), and contains 1271 four-line stanzas. With it Bodmer published the "Lament" over the heroes who perished in the great slaughter; but this has little to do with the other poem, though in most, if not all, the manuscripts it accompanies it. In 1772 C. H. Müller in his "Collection of German Poems of the twelfth, thirteenth, and fourteenth centuries," published not only the "Chriemhild," which begins with that queen's second wedding to Etzel, but also the first part, not known to Bodmer, containing the account of Chriemhild and Siegfried, of Brunhild and Gunther, &c. This first part is told in nineteen lays, containing 1188 four-line stanzas, and is therefore as nearly as may be equal in extent to the second. The first part far exceeds the second in variety of adventure and interest, but at the same time it has nothing to compare for fierce power of imagination to that final ghastly account of the massacre of the Nibelungs which closes the whole poem in so wonderful a way.

The main features of the Brunhild episode, but with great differences, are found in the *Völsung-Saga*, and Chriemhild, too, may be traced there as the Princess Gnd-run; with these are interwoven the deeds of Hagen (Haco of Norway), of Dietrich of Bern (probably Theodoric the king of the Ostrogoths, Bern being Verona), and Etzel (Attila, king of the Huns), with daring violation of probability and chronology alike. Much is supposed to be already known in the Nibelungen-lied. The early history of SIEGFRIED is taken for granted, and must be supplied from other equally ancient poems to moderns not acquainted with what was common property in the time of the old poet. To confuse matters still more, the most recent presentation of the myth, that in the cycle of the four opera-dramas of Richard Wagner, runs upon the Norse version rather than the Teutonic, and has but little connection with the Nibelungen-lied proper.

The bare outline of the groundwork of this grand poem runs thus: Siegfried, prince of the Netherlands, wandering in search of adventures in Nibelungen-land (the land of Nif or mist—query, Norway), finds two brother-kings there perplexed as to the division of the Nibelung-hoard, a treasure so vast that "twelve waggons in four days and nights, each going three journeys," would be required to remove its jewels, to say nothing of the gold, &c.; and, indeed, the latter replenished itself as often as it was broken in upon. The kings gave Siegfried the magic

sword Balmung, which lay among the hoard, as a fee that he might part the treasure for them. Quarrels arose, though Siegfried did his best; ultimately fighting came also, and in the end the kings and their retinue of giants were slain, and Siegfried became king of the Nibelungs. The Nibelungen-lied opens with the description of the charms of Chriemhild, and as a specimen of the language and versification a stanza may be here given:—

"Es wirts in Burgonden
Ein vil edel magedin,
Das in allen landen
Nicht schöner mohte sin;
Chriemhilt was si geheizen;
Si wart ein schone wip,
Darumbe mûsen degene
Vil verliesen den lip."

(There grew up in Burgundy a right noble maiden, so that in all lands no lovelier might there be; Chriemhild was she called; she was a lovely woman, and through her must many heroes lose their life.) Siegfried's coming to Burgundy, and his wooing of this peerless lady, is very prettily told. In his generous way he next offers to assist his bride's brother, King Gunther, to win the hand of the fierce maiden-queen, Brunhild, whose fame has reached Burgundy from her home in Isenland (Iceland), far over the sea. Siegfried has himself apparently already met and not liked the queen. In the article BRUNHILD it is told how fatally well he served his friend Gunther, and yet concealed his aid, so that when long afterwards all was discovered, Brunhild burned for vengeance. During a visit of Siegfried and Chriemhild to Gunther and Brunhild, ten years later than the double marriage, a quarrel for precedence arose between the queens; and Chriemhild, knowing the whole circumstances of the subduing of Brunhild, so taunted her rival and sister-in-law with the facts, and more than the facts, that Brunhild, believing the worst insinuations of her foe, induced her husband's uncle, Hagen, to murder Siegfried, whom she wrongly regarded as the author of her shame. This was not an easy task, for the hero was almost invulnerable. He was often called the horny Siegfried, for his skin had become as tough, though not as hard, as horn, through bathing in the blood of a dragon he had killed when a youth. But a leaf floating down from the trees above had clung between his shoulders, and that spot had been therefore untouched by the magic blood. Hagen, under pretext of anxiety for Siegfried's life, wormed out the secret of this spot from Chriemhild, so that he was able fatally to stab the hero in the back during a hunting party, Gunther standing by. Nay, Gunther profited by the murder, for he managed to gain the confidence of his sister and to induce her to send for the Nibelung-hoard. She, half demented with grief, and caring no more for anything, heedlessly consented. The hoard arrived, and was at once seized by the Burgundians, whose treachery served to deepen further Chriemhild's thirst for revenge.

Years go on, and the second part of the epic (Chriemhild's vengeance) opens with the arrival of an embassy from Etzel, king of the Huns, soliciting the widowed queen's hand in marriage. Chriemhild consents, seeing her way to vengeance through this union.

As soon as she could arrange it Chriemhild accordingly induced her new husband to invite the Nibelungs to a visit of rejoicing at his court. King Gunther, by possession of the Nibelung hoard, had become King of Nibelungen-land in succession to Siegfried, as well as of his own Burgundy, and in this part of the poem the Burgundians are therefore often styled Nibelungs. Hagen sank the whole Nibelung hoard in the Rhine before starting, and he, with Gunther and his brothers, swore mutual oaths never to reveal the spot while more than one of them lived. The Nibelungs (both Burgundians and Nibelungs proper) then start for the court of Etzel; and their voyage is as full of adventure as the Greek myth of the Argonauts. Hagen is the hero

throughout, and is all the more heroic in that he has a clear presentiment of his fate. As soon as they arrive, Chriemhild seeks to assassinate them, though her husband is loyally ignorant of her treacherous designs. Hagen, who wields Siegfried's sword Balmung, is ever vigilant, and defeats all her plots. At last the queen has her way, and fierce quarrel blazes forth. The Nibelungs seize the great hall, and there resist all attempts to conquer them. Host after host of the bravest of the Huns enter the hall only to perish, and the dead are cast out of the windows by the ever-lessening doomed band. The hall is set on fire, but cannot burn for the blood. Finally all the Nibelungs are slain but Hagen and King Gunther. These two are brought to the fierce queen by Dietrich of Bern, who had not before joined in the fray. Chriemhild asks her uncle Hagen where he sank the hoard. He replies by telling her of his oath. She savagely answers by ordering her brother's head to be struck off, and shows it to Hagen, who is thereby now left free to tell, since he alone survives. Hagen grimly reminds her that by her own act she has left the secret between God and himself, and he now refuses to divulge it. Chriemhild slays him with her dead Siegfried's sword; and thereupon the aged warrior Hildebrand, bethinking him that so furious a woman, through whom such hosts of brave men have perished, is herself not worthy to live, constitutes himself her executioner. The sword Balmung was taken home to the widowed and solitary Brunhild at Worms, and she restored it to Siegfried in his tomb. There she was found lying dead beside the hero whom we are to suppose she had loved as a girl, before ever she knew of Burgundy or its king, though Siegfried had not returned her love. The sword, fit emblem, lay between them. The treasure, fatal to all who had ever held possession of it, still reposes in the Rhine, as we are left to believe, to this day. The chief incidents of the poem are illustrated in a series of magnificent frescoes in the royal palace at Munich.

NICEÆ is the Latin name of the Greek *Nikaia* (called in English and French *Nice*, like its namesake on the Southern coasts of France), which was once a very celebrated Asiatic city, one of the chief towns of Bithynia, the province the western extremity of which embraced the Asiatic shores of the Bosphorus and the adjoining half of the Sea of Marmara. It stood on the shores of the Lake Ascania, about 20 miles inland from the Sea of Marmara, and owed its foundation to Antigonos the Great (about 320 B.C.), and its name of Nikaia to its next possessor, King Lysimachos. It was a formidable rival to Nikomedea, the nominal capital of the province.

It was at Nikaia that the famous Council of Nice was held in 325 A.D., by command of the Emperor Constantine, to settle the terms of the creed, hence called the "Nicene Creed." The final part of this creed, as we now have it (beginning after "I believe in the Holy Ghost"), was afterwards added by the Council of Constantinople in 381. The formula whereby the church fixes the date for the festival of Easter was also arranged at this council. An earthquake seriously damaged Nikaia during the sittings; but a few years subsequently the city was rebuilt by the Emperor Valens more sumptuously than before. In 787, at a second great council held here, the worship, or rather reverentia adoration, of images was sanctioned in the church.

Nikaia stoutly resisted the tide of Ottoman conquest for a long time, and served as the bulwark to defend Constantinople. It fell at last in 1078, but was retaken during the First Crusade, in 1097. When the Latin empire of Constantinople was founded in 1204, Nikaia formed the centre of a small Greek empire under Theodoros Laskaris, and from this centre Constantinople itself was regained by the Greek emperors in 1261. The second Turkish conquest of Nikaia, in 1830, was final. It has never since been Christian. Its site is marked by a wretched village (Ionik) mocked by the splendid ancient double walls, which, wit

their four gates and many fragments of large buildings, still remain from the old Greek city.

NICANDER and **NICIAS**. See **NIKANDROS** and **NIKIAS**.

NICARA'GUA, a state of Central America, bounded on the E. by the Caribbean Sea, on the W. by the Pacific, on the N. by Honduras, and on the S. by Costa Rica. The area is estimated at 49,500 English square miles, and the population at about 400,000, consisting chiefly of Indian, negro, and mixed races. The state may be conveniently described as divided into three natural zones. The most eastern is a humid district, embracing the Mosquito Coast—the British rights over which were given up in 1860, though the Nicaraguan supremacy is still only nominal—and the primeval forests of the Atlantic sea-board, abounding in sandflies and mosquitoes, and yielding for trade purposes only mahogany and india rubber. Here the only port is Greytown, the formerly fine harbour of which has silted up, situated on a mouth of the principal river of Nicaragua, the San Juan, which flows from the south-eastern extremity of Lake Nicaragua. Though a fine river, its course is interrupted by rapids. This zone, together with the upland interior zone, is geologically characterized by early formations and by gold mines, which, however, are somewhat capricious in their yield. The great feature of the central zone is its vast grass plains, where cattle, horses, and mules are extensively bred. The third zone comprises a remarkable depression which, at a level of about 100 feet, breaks the great Central American plateau for about 300 miles, and the Lake Nicaragua and the landlocked Lake of Managua. This is the most fertile portion of the state, producing coffee, sugar, cocoa, tobacco, and indigo in abundance. Along its rocky coast there are several good harbours, the best of which is Realajo, the proposed terminus of the canal which has been given up in favour of that across the Isthmus of Panama. It is chiefly of modern volcanic formation, and is said to contain the greatest number of volcanic cones within the same space in the world. Several are still active, and a great eruption took place from Omotepe in 1883. Managua or Leon, the official capital (Granada, on the north-western shore of Lake Nicaragua, is the most important town), is built on the slope of a still active volcano. This state has been subject to perpetual revolutions. On the dissolution of the Republic of Central America, in 1838, it formed itself into a republic, and is at present governed according to the constitution of 1858, by a president (elected for four years) and two legislative chambers.

NICARA'GUA, LAKE OF, the largest lake of Central America, lies in the state of that name, 11 miles from the Pacific Ocean and 80 from the Caribbean Sea, into which it discharges its waters by the river San Juan, its only outlet. The length of the lake is 110 miles, and the average breadth 35 miles. Its surface is 128 feet above the level of the Pacific. If the proposed canal had been carried out, the lake would have played an important part in the communication between the Atlantic and the Pacific Oceans.

NIC'COLO PISA'NO, that is, Nicholas the Pisan. See **PISANO**.

NICE or **NIZZA**, the ancient *Nikaia*, founded by the Greeks of Massilia, formerly belonged to Sardinia. It is now the capital of the French department Alpes Maritimes, and a free port. It is situated on the Mediterranean coast, about 10 miles eastwards from the mouth of the Var, and 789 from Paris. It contained 66,279 inhabitants in 1882, including the garrison and visitors. It is pleasantly situated in a plain, protected on the north by the Maritime Alps, and open on the south to the sea. A high and pointed rock, laid out in gardens, overhangs the town, and the Paglion, a mountain torrent, passes it on the west side, separating it from the suburb called

La Croix-de-Marbre, where some of the houses are painted externally in fresco and surrounded with gardens containing orange and lemon trees. The town is divided into the old and new, united by four bridges. Several fine terraces serve for defences of the town against the sea and for public walks. The ramparts of the town on the land side form also a promenade. The Cathedral of Santa-Reparata is the chief public building. The climate of Nice has been much celebrated for its mildness, but is liable to great and sudden variations of temperature. The mean of the year is 60° Fahr.—in summer 72°, and in winter 47°. The neighbourhood of the Alps, and the prevalence of the *Vent de Bise*, a keen searching wind, render the air frequently very cold and even frosty in winter and spring; and the heat in summer is sometimes excessive. It is, however, much resorted to by invalids. The water supply was greatly improved in 1883-84, and the walks and rides in the neighbourhood are agreeable. Among the public edifices are—a palace, cathedral, convents, and hospitals; a theatre, bath establishments, a Russian church, an English church, a triumphal arch, many hotels and boarding-houses, and a library. The town has silk, cotton, and paper mills, a great number of oil mills, and a tobacco manufactory. Soap, wine, liqueurs, essences, superior turnery, inlaid tables, boxes, trays, and penfucry are also made. The port, which is protected by a mole, is spacious and secure. The chief trade is in silk, oranges, fruit, and the manufactures of the town. The roadstead affords good anchorage. Nice was the birthplace of the painter Vanloo, of the astronomer Cassini, and of Garibaldi. Marshal Masséna was also born in its vicinity. It was ceded by Sardinia to France in 1860, with the neighbouring territory.

NICENE CREED, THE. See CREEDS.

NICHOLAS was the name assumed by five popes. **NICHOLAS THE GREAT** (Nicholas I.) was the first pope to bear that honourable epithet after the great Gregory (590-604), and it was as well deserved by him as by his noble predecessor. Nicholas the Great reigned from 858 to 867, succeeding Benedict III., and succeeded by Adrian II. He was of noble Roman family, and his election was welcome to the Frank emperor, Ludwig II., who was present at his coronation. Hardly was Nicholas seated on the throne of St. Peter than he was called on to interfere in the affairs of the Greek Church, where Photios had driven Ignatius from the patriarchal see of Constantinople. [See GREEK CHURCH; PHOTIOS.] The end of the Pope's interference was that Photios, having been deposed by Nicholas in 863, impudently decreed in his turn the deposition of Nicholas in 867—the sees of Constantinople and Rome being then not so far from equal in importance, and the constant presence and support of the "Roman" emperor (commonly called the *Greek* or *Byzantine* emperor by us moderns), even giving Constantinople at times the pre-eminence so persistently claimed by Rome. There is no doubt that this severe quarrel had a great deal to do with the eventual separation of the Greek Church as a distinct body from Rome. The bearing of Nicholas throughout was that of a statesman, and had he outlived the "Roman" Emperor Michael, the great supporter of Photios, no doubt the breach would have been healed, instead of having been widened as it was by his injudicious successors. Nicholas supported not only the supremacy of Rome and the unity of the church, but the sanctity of marriage, and the right of clerical appeal to Rome. No threats, no adverse decisions of bribed clerics, no forged confessions, and not even the armed occupation of Rome, could induce the courageous pontiff to release Lothar, king of Lorraine (Lotharingen), the Frank emperor's brother, from his guiltless wife Thietberga, whom he falsely accused of light conduct before marriage. To his dying day the Pope exhorted the queen to be brave and hold her honour as a wife, and had the satisfaction of seeing her restored to her

rank as he himself passed away. As for the clergy, it was Nicholas who set the precedent of their appeal to the Pope against the tyranny of ecclesiastical superiors, and he fought this through with the princes of the church on more than one occasion, and fortunately was always victorious. Nicholas I. received the Bulgarians into the Christian faith, and his long answer to all the 106 questions of King Bogorus is still extant (866). It is unfortunate that this great and good pope was led (865) into a belief in the genuineness of the spurious *ISIDORIAN DECRETALS*, the acceptance of which is one of the blot upon the Church of Rome.

NICHOLAS II. (*Gerard of Burgundy*) reigned from 1058 to 1061, coming after Stephen IX. and before Alexander II. He owed his election to the enormous influence of the monk Hildebrand (Gregory VII.), who relied upon him to put down the antipope Benedict X. Nicholas II. accomplished this (1059), and further in the same year organized and received the submission and tribute of the new Norman kingdoms of Naples and Sicily under Robert Guiscard. Under his hands, guided by Hildebrand, the power of the popes was very largely raised.

NICHOLAS III. (*Girolamo Gattano*, a member of the Orsini family), elected by his great family influence in 1277, reigned till 1280 only. He found Italy in a welter of confusion. The French Charles of Anjou was senator of Rome and viceroy of Tuscany, both of which dignities Nicholas was strong enough to resume in his own person. The German Emperor Rudolph was forced to gain his alliance at the price of the rich province of Romagna, which with the exarchate of Ravenna was now restored permanently to the Roman see. In spite of these great strides towards the unity of Italy by freeing the land from French and German tyranny, Dante has placed Nicholas III. in the eighth circle of hell for his shameless appropriation of church preferences for his family (nepotism). The passage occupies the whole of the magnificent nineteenth canto of the "*Inferno*," and the poet's summing up is superb, tracing as he does the evil to the original source, the "*Donation*" of Constantine.

"Gold and silver, they were thy true God.
And from the idolator how differedst thou?
Thou worshipp'dst hundreds where he worshipp'd one.
Ah, Constantine! how much lo! has been wrought
By those great gifts which, when thou turned to Christ,
The first rich Father of the Church received!"

NICHOLAS IV. (*Girolamo of Ascoli*, of lowly birth) reigned from 1288 to 1292. When general of the Franciscans he condemned Roger Bacon to prison (1278) for his studies and writings, and this is his chief title to remembrance with Englishmen. As pope his most noteworthy act was the absolving of Charles the Lame, king of Sicily, from the obligation to carry out the treaty by which he had regained his liberty from Alfonso III. of Aragon, an act for which there would not seem to be any possible excuse. Nicholas IV. died, it was believed, of disappointment at the extinguishing of the last flicker of Christian dominion in Palestine on the fall of Ptolemais, and at his inability to stir up a new crusade. After his death the see was vacant two years and three months, when at length an ascetic monk (Celestine V.) was unwillingly forced to succeed.

NICHOLAS V. (*Tommaso Parentucelli*) reigned from 1447 to 1455. He was often called Thomas of Sarzana, being born at that place (near Spezzia) in 1389. His father was a physician, and gave him a good education. He was a devoted student and patron of learning, and his great abilities as tutor of noble families marked him out for promotion. He rose to be Bishop of Bologna, and in 1446 was created cardinal. It was only a month or two later that he was elected pope, through the conflict of two equally-balanced factions, neither of whom could carry its

candidate, and both of whom therefore agreed to accept his pious and learned man as a temporary expedient. Nicholas V. made a noteworthy pope. He succeeded in allying and dismissing the angry Council of Basel, which had so long defied the Roman see, and in obtaining the submission of the antipope elected by that council as Felix V. (1419). He now indulged his ardent love of culture of all kinds. He founded the noble Vatican library in 1447. He encouraged the Greek scholars who were being driven westwards by the victories of the Turks, and was diligent in the acquisition, translating, and copying of fine books by their means. Rome began to be a centre of learning and taste. The papacy rose in universal esteem. The peace allowed the arts to flourish, and the city was richly improved and beautified. A jubilee was celebrated in 1450; and in 1451 steps were taken by Nicholas, as was hoped, to finally effect the reunion of the Greek and Latin branches of the church. But in 1453 the good Pope was overwhelmed by the news of the capture of Constantinople by the Turks (29th May). He instantly preached a new crusade, but he was now sixty-six years old, and much afflicted with the gout, and he sank under the effort, expiring 24th March, 1455.

The antipope *Nicholas V.*, a Franciscan monk, whose name was Peter of Corvara, usurped the papal dignity at Rome, by the favour of the deposed German Emperor Ludwig, from 1328 to 1330, under the Avignon papacy of John XXII. Eventually he was forced to yield; he went to Avignon and formally submitted himself to the mercy of the Pope (August, 1330). He was kept in honourable captivity at Avignon till his death in 1334 or, as some say, 1336.

NICHOLAS I. (Nikolai Paulovich), Emperor of Russia, was the third son of Paul I., and was born at St. Petersburg on the 7th of July, 1796. He was only five years of age when his father was murdered and the crown conferred on his brother Alexander. In 1814 Nicholas commenced a series of travels over Europe, arriving in England in 1816. On the 13th July, 1817, he married the eldest daughter of Frederick William III. of Prussia. In 1825 Alexander died at Taganrog, and it seemed to be taken for granted the Grand-duke Constantine, the next heir, would ascend the throne; but Constantine resigned his claims to the crown, and on opening the late monarch's will it was found that he had nominated Nicholas as his successor. This event was announced by a proclamation issued by the Senate on the 23rd of December. But the republicans and the old Russian party, or supporters of Constantine, seized this departure from the regular order of succession as a pretext for insurrection, and a considerable body of the troops combined with the populace of the capital and took up arms against the new emperor. This insurrection was suppressed with great vigour and cruelty. Executions, confiscations, imprisonments, and exile to Siberia followed, and were inflicted with merciless severity. Nicholas soon found himself the sole and absolute master of the gigantic Russian Empire, and set himself with iron resolution to carry out the hereditary policy of his family. "Despotism," said he, "is the very essence of my government, and it suits the genius of the land."

Scarcely had Nicholas ascended the throne when he made war upon Persia. Hostilities continued till 1828, when the Shah was obliged to sue for peace, which, by the treaty of Turkmanchai, was granted him on condition of his ceding two fine provinces to Russia, and paying 20,000,000 of silver roubles towards the expenses of the war. Then followed a war with Turkey, in which victory, though at enormous cost, constantly attended the Russian arms; and by the peace of Adrianople (14th September, 1829) another increase of territory was obtained, as well as the free navigation of the Danube, the right of free passage between the Black and the Mediterranean seas,

and the payment of 11,000,000 of Dutch ducats. The Caucasus was included in the territory ceded to Russia by this treaty; and as the independent tribes who inhabited this mountainous region refused to acknowledge the supremacy of Russia, Nicholas, after an ineffectual attempt to gain over the chiefs by bribes, had recourse to arms. The struggle thus commenced continued during the remainder of his life at an enormous waste of men and money, and with little honour to the Russian arms.

In November, 1830, the Polish insurrection broke out, and after a heroic resistance for nine months, the Poles were completely crushed. The most cruel vengeance was inflicted on the vanquished, and an iron despotism substituted for the semblance of constitutional government that had previously been permitted to exist. The policy of Nicholas in trying to extinguish the Polish nationality was viewed with great dissatisfaction throughout Europe. He again visited England in 1841, and Austria and Italy in 1846. He stood aloof from the revolution in Germany in 1848, but readily responded to the call of Austria for aid against the Hungarians in 1849. He united with Austria in demanding from the sultan the surrender of Kossuth and the Hungarian refugees, and attempted to coerce him into compliance; but the appearance of a British fleet in the Dardanelles compelled him to abandon his disgraceful demand. Meanwhile his designs on the Turkish dominions had been steadily pursued, and in 1853 he thought the time had come to carry the long-cherished designs of his family into execution. The Czar Nicholas made a demand upon the Porte, with reference to the sovereignty of the Greek Church in Turkey, which the sultan refused, and a Russian army crossed the Pruthi. But England and France at once interposed for the protection of Turkey, and sent their fleets and armies to her assistance. This unexpected opposition, and the czar's invincible repugnance to giving up his long-planned scheme of conquest, brought on the Crimean War, during the course of which the great author of it died at St. Petersburg, 2nd March, 1855, of congestion of the lungs. His death was doubtless hastened by grief at his defeats, and by over-anxiety and excessive labour. He was herculean in stature and strength, and was remarkably handsome and well proportioned. He was simple and abstemious in his personal habits, and industrious to an eminent degree; but his vanity and insane pride made him think himself infallible. At the same time he was much beloved by his Russian subjects. His eldest son succeeded him on the throne, as Alexander II.

NICHOLAS, ST., a favourite saint of the Roman Catholic Church, the patron saint of children and sailors, and the national saint of Russia, was, according to the Roman breviary, a native of Patara in Lycia. Many miraculous stories are related concerning his conception, infancy, and youth, and it is asserted that by the special indication of the Holy Spirit he was elected bishop of Myra, the capital of his native province. During his term of office he displayed every episcopal virtue; suffered imprisonment in the persecution of Diocletian, opposed the Arians at the Council of Nice, and died a natural death in 342. His supposed relics were translated to Bari in Apulia by Robert Guiscard in 1087, the anniversary of this translation, 6th May, being in the Russian Church still observed as a festival. As a matter of fact the name of this bishop does not appear among the signatures of the decrees of the Nicene Council, and no mention of his name can be found in the writings of any of the church historians of that or the succeeding century. The earliest extant trace of his existence is the fact that a church was dedicated to him in Constantinople about the year 560. His fame rests chiefly on the traditions preserved both in the East and in the West of numerous miracles wrought through his intercession. Children, and especially schoolboys, are regarded in Russia, Greece, and Northern Europe generally as being

the peculiar care of St. Nicholas, and as the vigil of his feast falls on the 6th December, the children in many places appeal to his liberality by hanging up a stocking or placing a shoe to receive his Christmas gifts. In England his feast was celebrated in ancient times with great solemnity, and the installation of a Boy-Bishop, an account of which has already been given under that heading.

NICHOLAS OF BASEL, known among his adherents as the Great Layman or the Great Friend of God, an eminent mystic of the fourteenth century, was born at Basel in 1308. The son of a rich merchant, he inherited considerable wealth, and he seems at first to have devoted himself to the pursuit of pleasure, but he afterwards passed through some severe spiritual struggles, from which he emerged an earnest teacher of religion. It was a period of much political and social disorganization, and devout men were led to form, independently of the church, little societies for mutual edification and assistance. One of the more important of these societies was formed by Nicholas, and its members adopted the title of "The Friends of God." It included within its ranks both men and women drawn from all classes of society—nobles, knights, rich merchants and their wives, priests, monks, and nuns. Their piety was unmistakable, and though their doctrines were of a mystical character, they preserved outward conformity to the church. The most eminent of the converts of Nicholas was the celebrated Dominican preacher, John Tauler, whose religious views and preaching were completely changed, through the influence of a visit from Nicholas in 1346. For many years Basel formed the centre of the *Gottes Freunde*, but in 1380 its organization appears to have been broken up, and Nicholas with two friends retired into Austria. He was ultimately arrested on a charge of heresy, his chief crime being that "he audaciously affirmed that he was in Christ and Christ in him," and being found guilty he was publicly burnt at Vienna, the exact date of his execution being unknown.

During his lifetime he had attracted but little public attention, and after his death his memory soon disappeared. Even his name was forgotten, and though there were references in mediæval history to a mysterious person styled "the Great Friend of God," nothing definite was known about him. One of the Friends, however, Rulmann Merswin, a banker of Strasburg, had collected many letters and documents belonging to the society, and had bequeathed them to a convent of the Knights of St. John, which he founded in that city. Among its archives they remained unheeded for centuries, and it was not until some 400 years had passed that they were discovered in the library of the university by Professor Carl Schmidt, who was thus enabled to identify Nicholas of Basel with the "Great Friend of God," and with the mysterious visitor whose interview had so great an influence upon Tauler. (See C. Schmidt's "Nicolaus von Basel, Leben und Wirken," Vienna, 1866.)

NICHOLS, JOHN, F.S.A., a celebrated antiquarian and author, was born at Islington, 2nd February, 1745. When not quite thirteen he was placed with William Bowyer the printer, to whose business he succeeded in 1777, and in 1778 the *Gentleman's Magazine* passed into his hands, which he edited until his death, 26th November, 1826. He was the author or editor of fifty-seven separate works, of which the chief are the "Literary Anecdotes of the Eighteenth Century" in nine large octavo volumes (1812-15), and continued with the aid of his son as "Illustrations of the Literary History of the Eighteenth Century," the first volume of which appeared in 1817, and the eighth and last in 1858. He also published the "Biographical Anecdotes of William Hogarth" in 1781, and his "History and Antiquities of the Town and County of Leicester," in four folio volumes, between 1795 and 1816. Another interesting and useful work was his "Illustrations

of the Manners and Expenses of Ancient Times in England," published in 1797.

JOHN BOWYER NICHOLS, son of the preceding, born 15th July, 1779, was educated at St. Paul's School, in 1796 joined his father in business, and was sole proprietor of the *Gentleman's Magazine* from 1833 till 1856. He edited the fifth, sixth, seventh, and eighth volumes of the "Illustrations," and was the author of "Anecdotes of Hogarth," &c., 1833, and of volumes descriptive of "Fonthill Abbey," the "Gulldhall of the City of London," &c. He died 19th October, 1863.

JOHN GOUGH NICHOLS, son of the preceding, born in 1806, followed as a literary antiquary in his grandfather's footsteps. He was for a long time one of the editors of the *Gentleman's Magazine*, and he helped to found the Camden Society, for which he edited a number of important works. He was also the editor of "The Literary Remains of Edward VI." and of other works issued by the Roxburghe Club. He died 13th November, 1873.

NICKEL. This metal was first discovered by Cronstedt in 1757. It is allied to cobalt and iron, and is found associated with these metals in meteorites and in most of the ores. It is also contained in the atmosphere of the sun. It was first obtained from kupfer-nickel, so called by the old German miners under the impression that it was false copper ore. It is found in Styria and at Leadhills. This is an arsenide of the metal. The other ores are the arsenate or nickel-bloom, the arsenio-sulphide or nickel-glance, the sulphide or germanite, and the carbonate or emerald nickel. It has been recently found in New Caledonia in large quantity in an important new source, garnierite, a silicate of nickel. From kupfer-nickel it is usually obtained by roasting off the arsenic, fusing the residue with sand, and reducing the impure oxide so obtained with charcoal. A purer product is procured by dissolving out the nickel from the roasted mass by hydrochloric acid; the solution requires much purification to separate associated metals, especially cobalt, for which many different processes are followed, and the nickel is precipitated from the pure solution by an alkaline carbonate. The precipitated nickel carbonate is redned with charcoal in a powerful blast furnace. The New Caledonia ore is free from cobalt; it can be treated at once by hydrochloric acid, and the solution precipitated with oxalic acid to obtain the oxalate. The metal may be obtained in the purest form by reducing the oxalate with charcoal.

Nickel is a ductile and malleable metal of a silver white colour, and capable of a fine polish. It is extremely infusible, requiring a temperature nearly equal to that of iron. It is magnetic, a property which is lost on heating to 250° C. (482° Fahr.), and recovered on cooling. The specific gravity is 8.9; the symbol is Ni; the atomic weight is 58.8. It has a tenacity equal to iron. Heated in oxygen gas it burns in the same way as iron, and is converted into oxide. This oxide is also reducible by heating in hydrogen, the resulting pulverulent metal taking fire in the air. The best solvents are nitric and nitromuriatic acid, but it is soluble also in dilute sulphuric, and in hydrochloric acid, with a solution of hydrogen. It is easily deposited from solution by electrolysis, and nickel electroplating is carried on on a large scale, especially in America, where it is extensively employed in coating the finer articles of iron and steel work. The best salt for this purpose is the nickel ammonium sulphate.

It is harder than silver, and grayer in colour, but takes on a fine polish. It fuses at a bright red heat. It acquires a slight tarnish in air, but remains quite bright in water containing $\frac{3}{100}$ part of potash hydrate. Meteoric iron is another common alloy of iron and nickel. The proportion of nickel varies from 5 to 15 per cent. Some of the other alloys are found native, as those of arsenic and antimony.

It forms many white alloys, of which the most important is that of nickel, copper, and zinc, known as German silver or nickel silver, an alloy enormously used as the basis of electro-silver-plated goods. It varies in composition; the following are the analyses of three kinds used in Birmingham for plated articles:—

Zinc, . . .	17.01	...	22.15	...	26.05
Nickel, . .	19.13	...	15.05	...	10.85
Copper, . .	63.31	...	62.40	...	62.63

99.18 99.60 99.53

There are two oxides of nickel—the protoxide (NiO) and the sesquioxide (Ni_2O_3). The latter does not form salts, it is a black powder, having a specific gravity of 4.81, easily reduced to the protoxide by ignition. The protoxide, obtained by calcining the nitrate, is a dense green powder; it has been found native. As a hydrated oxide ($\text{Ni}_2\text{O}_3 \cdot \text{H}_2\text{O}$), it is thrown down as an apple-green precipitate from solution of salts of nickel by caustic soda or potash. It is soluble in ammonia, forming a violet solution. It is soluble in acids, forming salts which are yellow when dry, green when in solution. Nickel sulphate ($\text{NiSO}_4 \cdot 7\text{H}_2\text{O}$) is the most important of the salts; it forms green prismatic crystals, and beautiful double sulphates with those of potassium and ammonium. Nickel chloride (NiCl_2) is a soluble salt, obtained in green crystals. Nickel burns in chlorine gas, forming golden-yellow scales. Nickel carbonate (NiCO_3) is a pale green powder. Nickel is easily detected in solution by the following reactions:—Caustic alkalis give a pale green precipitate, insoluble in excess; ammonia gives a similar precipitate, soluble in excess, with deep purple colour; potassium cyanide gives a green precipitate, soluble in excess, with amber colour, reprecipitated by hydrochloric acid; ammonia sulphide gives a black precipitate.

NICE, NICIAS. See **NIKE, NIKIAS**.

NICK NAME, a corrupted form of *an eke name*, i.e. an added name, an *ag-nomen*. Nicknames are given for personal or family or national peculiarities, and have therefore a serious side, inasmuch as they furnish forth a considerable proportion of our surnames. See **SURNAMES**.

NICOBAR ISLANDS are situated in the Indian Ocean, in the same latitude as Ceylon, and about halfway between the northern point of Sumatra and the Andamans. They consist of twenty islands in all—the largest 30 miles in length, the smallest only 4. Camorta is the second largest of the group. Together with the adjoining islands of Nancowry and Trinkati, it forms the splendid natural harbour known as Nancowry, distant 225 miles from Port Blair and 390 miles from Rangoon. The surface is hilly, and the hills in some places are rather high. The islands are in general covered with trees, and only a few tracts along the shores are cultivated. The soil is very fertile, yielding in abundance cocoa-nuts, oranges, sugar, tobacco, and bamboos. The aggregate population is about 6000, many of whom are engaged in the collection of sea-slugs and edible birds' nests. Their origin is doubtful, but their resemblance to the Chinese is quite as great as it is to their neighbours the Malays. Repeated attempts at colonization had failed, on account of the prevalence of yellow fever; but another effort was made in 1869 by the British, who took a company of native troops from the Andamans, and occupied the three northern islands. Drafts of convicts from the Andamans were also sent here, and for several years extensive sanitary works were carried out, rendering the islands far more healthy than formerly.

NICOL PRISM, the principal means for obtaining the polarization of light. It is superior to the polarizing mirror, which acts by reflection, because it gives a more complete polarization; and to tourmaline plates, because the ray emitted is colourless.

A Nicol prism (so called from the name of its inventor

is made by bisecting a rhombohedron of Iceland spar (usually about an inch high) through the obtuse angles of the crystal. The two halves are then joined by Canada balsam. Then, as the refractive index of the balsam (1.549) is less than the "ordinary" index of Iceland spar (1.654), the ordinary ray is totally reflected at the surface of the balsam and so thrown aside; but Iceland spar splits light into two oppositely polarized rays, which it refracts differently, and the index of refraction for the second or "extraordinary" ray (1.483) is less than the refractive index of Canada balsam (1.549), so that this extraordinary ray traverses the balsam layer and emerges alone.

The *Foucault prism* differs only from the Nicol in the absence of the Canada balsam, the thin layer of air between the halves of the crystal being found for many purposes better than the balsam; but the field is smaller than with the Nicol proper, and some considerable amount of light is lost. Notwithstanding these drawbacks, it is now generally recognized as on the whole superior to the older form.

NICOLAI EFF. See **NIKOLAI EFF.**

NICOLE, PIERRE, one of the distinguished recluses of Port Royal, was born at Chartres on the 19th of October, 1625. At the age of fourteen he was sent to study at Paris, where he was persuaded to join the community of the Port Royal, and he occupied himself in instructing the pupils confined to the institution. He formed an intimate acquaintance and a species of alliance with Antoine Arnauld. The angry disputes regarding the five points of the Jansenists prompted him to remain for several years a simple clerk, but in 1676 he was induced to seek holy orders. The necessary consent, however, was refused by the Bishop of Chartres, who disliked his opinions. He was a man of simple habits and candid mind. He died on the 11th of November, 1695. He was the principal author of "La Logique, ou l'Art de Penser" (1698), known as the Port Royal Logic.

NICOMEDEIA (*Nikomêdeia*), a city of Bithynia, at the head of the Gulf of Astacus in the Propontis, was founded by **NIKOMEDES I.**, B.C. 264. Under the Roman emperors it became one of the chief cities of the empire. It is now called Ismid, and is still a town of importance, but contains few remains of antiquity.

NICOTINE, a volatile alkaloid found in tobacco (*Nicotiana Tabacum*, natural order Solanaceæ). The quantity contained in the different kinds of tobacco varies from 2 to 7 per cent., that of Havanna and Maryland containing the least. It is a colourless oil with a burning taste even in dilute solution. It is extremely poisonous, and causes choking. It does not freeze, and boils at 250° C. (482° Fahr.). It is soluble in water, alcohol, ether, and oils. It dilates the pupil of the eye, and is used in medicine, in doses of $\frac{1}{16}$ to 1 grain, in tetanus, and also as an antidote to strychnia. It is a strong alkaline base, having the formula $\text{C}_{10}\text{H}_{14}\text{N}_2$, and forming definite crystalline salts, as the hydrochlorate ($\text{C}_{10}\text{H}_{14}\text{N}_2\text{HCl}$). The platinum salt, in ruby-red crystals, has the formula $\text{C}_{10}\text{H}_{14}\text{N}_2\text{HCl}_2\text{PtCl}_2$.

Tobacco also contains nicotine or tobacco camphor, a white crystalline body soluble in water, alcohol, and ether, and having the formula $\text{C}_{10}\text{H}_{12}\text{N}_2\text{O}_2$.

NIEBUHR, BARTHOLOMÆUS GEORG, a distinguished historian, the only son of **KARSTEN NIEBUHR**, was born at Copenhagen, 27th August, 1776. He spent his infancy and boyhood at Meldorf in Holstein, and in 1794 proceeded to the University of Kiel, where he remained two years. In January, 1796, he became private secretary to Count Schimmelmann, the Danish minister of finance; but finding himself unsuited to the position, he exchanged it for that of supernumerary secretary to the Royal Library. In 1798 he paid a visit to Great Britain which lasted a year and a half, residing chiefly at London and Edinburgh, at the latter place making the acquaintance of Sir Walter Scott,

and on his return to Denmark he was appointed assessor in the East Indian department and secretary to the African consulate. In 1806 he entered the service of Prussia as joint director of the chief Berlin bank, and in 1809 was sent to Holland to negotiate a loan. His opposition to the financial policy of the government led to his temporary withdrawal from public life in 1810, and the exchange of his financial post for that of royal historiographer. In the same year he became a member of the Royal Academy of Berlin, and on the opening of the University of Berlin he commenced a course of lectures on Roman history, which were published in 1811, and which contain the germs of those new combinations and discoveries by which he will be best known to posterity. In 1815 he lost his father, and he spent the remainder of the year in writing his biography, which appeared in 1816. In the latter year he was appointed ambassador to the Papal court, and on his way to Rome he discovered at Verona the long-lost "Institutes" of GAIUS, which were afterwards published by Savigny. At Rome, though busy with diplomatic business, he continued to deepen and extend his studies, and he assisted Cardinal Mai in his edition of Cicero's "De Republica," and contributed several chapters to the great work of Bunsen and Platner on the topography of ancient Rome. In 1823 he resigned the embassy and established himself at Bonn, where he spent the remainder of his life. He here entirely recast his "History of Ancient Rome," publishing the first volume of the new edition in 1827, the second in 1830. He also wrote a third volume, bringing the narrative down to the end of the first Punic War, which was edited by Professor Classen, and published posthumously. He also assisted in Bekker's edition of the Byzantine historians, and lectured in a non-official capacity at the university on ancient history, ethnography, and geography, and on the French Revolution. He died 2nd January, 1831.

His "History of Rome" is one of the most original works this age has produced, and it marks an epoch in the study of ancient history. It had already been shown by other writers that the early history of Rome, as it had been handed down to the moderns, was a mass of disjointed fable and uncertain tradition; but it was Niebuhr who first attempted, by the aid of philology, ethnology, and archaeology to discover the elements of truth latent in this mass, and from these materials to reconstruct a genuine record of the past. To this task he brought the qualifications of immense learning, profound judgment, a wonderful memory, and a powerful imagination, which enabled him to realize the life and reality of social conditions which had long passed away. Many of his theories have been greatly modified by later workers in the same field, but his method of inquiry has been so eminently fruitful and suggestive that he is justly entitled to the honour of being the founder of the modern science of historical reconstruction.

His history was partly translated into English by Archdeacon Hare and Bishop Thirlwall, and the translation was completed by Dr. William Smith and Dr. Leonhard Schnitz.

NIEBUHR, KARSTEN, a distinguished modern geographer and traveller, a native of the duchy of Lauenburg, on the southern confines of Holstein, was born 17th March, 1733. He passed several years of his youth in the condition of a peasant, working as a common day labourer. In his twenty-first year, some legal proceedings rendering necessary the employment of a land-surveyor in his native district, he resolved to qualify himself for the office, and applied zealously to the study of geometry. When he became of age he disposed of the wreck of his little patrimony, and employed a portion of it in acquiring higher instruction in mathematics, first at Hamburg, and subsequently in the University of Göttingen. In his twenty-fourth year he entered the corps of Hanoverian engineers, but was soon diverted from that service by an offer of employment from

the Danish government to join a scientific expedition to Arabia, in the capacity of mathematician or geographer. The expedition sailed from Copenhagen in January, and reached Cairo in November, 1761. Having carefully explored the pyramids and other antiquities of Lower Egypt, they crossed to Arabia Felix in December, 1762. They finally arrived at Mocha, in May, 1763. Niebuhr having visited Yemen and other little known parts of Arabia embarked in an English vessel for Bombay (where the last of his fellow-travellers died), proceeded to Persia, Syria, &c., and so by way of Constantinople back to Copenhagen, November, 1767. His well-known "Description of Arabia" appeared in 1772, and was followed in 1774-78, by "Travels in Arabia and Circumjacent Countries." His inquiries into the state of the Mohammedan religion and Turkish Empire, and his astronomical observations, were not published till 1835, long after his death. Niebuhr died 26th April, 1815.

NIELLO, a method of ornamenting metal plates which was practised by the ancient Romans, and after being preserved as a living art in Europe down to the end of the sixteenth century, survives in Russia and India at the present day. In niello work the design was first sketched with a "style" upon the plate, and then deeply engraved with a burin or graver. An amalgam of silver, copper, lead, and sulphur in a finely powdered state was then shaken on to the plate so as to cover all the engraved part, a solution of borax having been first brushed over the surface to act as a flux. The plate was then carefully heated over a charcoal fire, fresh amalgam being added as the powder fused upon any defective places. When all the lines were filled the plate was allowed to cool, and after the superfluous niello had been scraped away the plate was very highly polished, till it presented the appearance of a smooth metal surface enriched with a delicate design in fine gray-black lines, the effect being something like that of a pen and-ink drawing. The earliest specimen of niello work known is believed to belong to the first century, and the art was freely used to decorate the metal work produced by the Byzantine artists during the period which lasted from the sixth to the twelfth century. It was practised throughout the whole of the mediæval period in Italy, France, Germany, England, and Ireland, and many beautiful specimens are to be found in the palaces and museums of these countries. The "bidri work" produced at Bedar in Hyderabad is a variety of niello. Niello work is regarded as the parent of copper-plate engraving, in the modern sense of the term—that is, for taking impressions on paper. The first to practise the art is said to have been one Tommaso Finiguerra, a Florentine niello-cutter, since whose time engraving has been a distinct profession. See ENGRAVING.

NIEMEN is the Polish name of a river which by the Germans is called *Memel*, and by the Lithuanians *Niemona*. It rises between 53° and 54° N. lat., and near 27° E. lon., and flows past Grodno to Tilsit, forming part of the boundary between Russia and Prussia. About 8 miles below Tilsit the river divides into two arms, which branch off respectively to the north-west and south-west. The northern arm, called Russ, divides again, about 2 miles from its mouth, into two arms, the Atmat and Skirwieck. The southern arm is called the Gilge. Both arms empty themselves into the Kurische Haff. The delta included between the Russ and Gilge, called the island of Kaukehnen, is alluvial and of great fertility, but swampy. Though impeded by shoals at several places, the river is always navigable, and is of great importance for the exportation of the produce of the adjacent countries. Its floods and inundations are often terribly destructive. Near Tilsit Napoleon I. and Alexander of Russia held a memorable interview in June, 1807, on a raft moored precisely in midstream, between the armies on either bank.

NIEVRE, a department in France, formed out of the old province of Nivernais, is bounded north by the department of Yonne, east by Côte-d'Or and Saône-et-Loire, south by Allier, and west by Cher and Loiret. Its greatest length from north-west to south-east is 79 miles, from south-west to north-east 65 miles. The area is 2630 square miles, and the population in 1882 was 347,576.

Surface and Hydrography.—The Morvan "Black Forest" hills lie along the eastern boundary, and send out towards the north-west numerous branches; one of which traverses the department from north-west to south-east, and forms part of the watershed between the basin of the Loire and that of the Seine. The portion of the department belonging to the basin of the Seine is drained by the Yonne and its feeders, and has a general inclination towards the north. The larger portion of the department lies on the south side of the watershed, and consists of extensive and sandy but tolerably fertile plains, sloping down to the Loire, which crosses the south-western angle of the department, receiving the Aron and the Nièvre, a small stream that gives name to the department, on the right bank, and the Allier on the left. The western boundary of the department is formed by the Allier and the Loire. The Allier, the Loire, and the Yonne are navigable; the two last are joined by the Canal-du-Nivernais.

Soil and Products.—Though the soil of the department is in general poor, yet corn enough for the home consumption is raised by careful husbandry. The mountains supply abundant pasture, and a large number of cattle and sheep are reared. In the arrondissement of Clamecy, and in the districts that belong to the basin of the Loire, the produce includes wheat, wine (of good quality), fruits, hemp, leguminous plants, &c. The hilly country—to the extent of one-third of the department—is covered with extensive forests of oak, maple, and beech trees; timber forms one of the principal sources of wealth to the inhabitants, and is conveyed by water to Paris and other large towns. The climate is temperate and healthy, but rather damp. Several iron mines are worked, and the ore is smelted and converted into iron and steel in a great number of works, the most important of which are those of Pont-St.-Ours, Imphy, and Fourchaubault. There are some coal mines, and lead, copper, and silver are also found. The department is divided into the four arrondissements of Nevers, Château-Chinon, Clamecy, and Cosne. The chief town is NEVER.

NIFELHEIM or **NIFLHEIM** (*nifl*, equal to the Teutonic *nebel*, cloud), the land of mist, part of the kingdom of Hel—that is, the Hades of the Norse mythology. It was a region of everlasting cold and twilight. The spirits of those who died of disease and old age went at death to this gloomy region. From the great pit in the midst of Nifelheim welled up the spring Hvergelmir, and thence sprang the twelve rivers (Eliwagar), which became the parents of ice, snow, wind, and rain as they flowed throughout the world with their freezing waters.

NIGELLA (Fennel flower) is a genus of plants belonging to the order RANUNCULACEÆ, and agreeing with other genera in the numerous stamens, and the carpels more or less separate. *Nigella arvensis* is considered by Mr. Carruthers and other authorities on the plants of the Bible, to be the plant intended by the prophet Isaiah in chap. xxviii. 25, and translated "fitches" (i.e. vetches). This view has been adopted in the Revised Version. The plant is about 1½ feet high, with finely cut fennel-like leaves and bluish flowers. The carpels in the centre of the flower are united almost to the top, and when ripe split along the upper margin. The numerous seeds are black, whence the generic name, a diminutive of Lat. *niger*, black. These seeds are pungent and aromatic, and are commonly used in Eastern countries to season dishes and

to spread on bread. *Nigella damascena* is often grown in gardens, and goes by various names, such as "love in a mist," "the devil in a bush."

NIGER or **QUORRA**, a great river of Africa, rising in that extensive mountain region which, under the name of the Kong Mountains, extends from the coast of Sierra Leone (13° W. lon.). The principal stream, as the Tenbi is now generally considered, rises in Mount Loma, 8° 36' N. lat. and 10° 33' W. lon., about 1600 feet above sea-level; then under the name of Joliba it flows N.N.E. to Timbuctoo, and then east, south, and S.S.W. into the Gulf of Guinea, under the name of Quorra or Kwara, entering the sea by numerous mouths, and forming a large, marshy, and very pestilential delta, whose protrusion into the ocean divides the Bight of Benin on the west from that of Biafra on the east. Its total length is about 2500 miles, and the area of its basin is about 700,000 square miles. The principal tributary is the Tchadda-Boune, which joins it from the east, in 8° N. lat. and 6° 40' E. lon., and appears to be nearly as large. The Niger is navigable for boats to within 100 miles of its source. Our popular name is that used by the ancients for some large river in Central Africa. It was explored by Mungo Park, and followed to the sea by Richard Lander. The middle course has been explored by Dr. Barth, and the Benue tributary by Dr. Baikie. The Niger is the great highway of the Western Soudan, being navigated by vast numbers of native vessels; and its navigation by trading steamers from the Atlantic, to the factories beyond the affluent of the Benue, is now regularly established. These vessels chiefly exchange European goods for palm oil, ivory, and shea butter. The principal towns are—Sego and Jemne on the upper river; Kabara, the port of Timbuctoo; on the central river—Say, Bussa, Raliba, Egga; Lokoja, at the confluence of the Benue, Iddah, Onitsha, Abo, on the lower river, and Akassa at the principal or Nun mouth of the delta. The delta occupies a space of about 9000 square miles. The bar at the mouth requires the greatest care in crossing.

NIGHT-APES or **DOUROU'COULI** (*Nyctipithecus*) is a genus of American monkeys, differing from the typical monkeys of the New World, the Cebidae, by the absence of a prehensile tail. The night-apes are entirely nocturnal in their habits, sleeping all day in the holes of large trees, and roaming about at night in search of food, which consists chiefly of small birds and insects, but also of fruits. They are small, furry, owl-faced monkeys with very large eyes. The tail is long but not prehensile. The ears are almost entirely concealed by the long hairs on the sides of the head; the colour of the fur on the upper parts of the body is gray; the lower parts are orange, and this colour also appears on the sides of the neck. The forehead exhibits three black lines, diverging backwards; and the tail is yellowish-gray, with the tip black. The length of the head and body is about 10 inches, and that of the tail 14. The best known species is *Nyctipithecus trivirgatus*, a native of tropical South America, which was first described by Humboldt. According to this traveller the douroucouli lives in pairs, and has for its size a remarkably powerful voice, its cry recalling the jaguar's roar. The night-apes make useful pets in their native country, keeping the house clear of bats and insect vermin.

NIGHT-HAWK (*Chordeiles virginianus*), a bird of the GOATSUCKER family (Caprimulgidae), is a well-known migratory bird in the United States, where it arrives in the month of April, returning again towards the south about the middle of August. It measures rather more than 9 inches in length, and is of a general blackish-brown colour, thickly sprinkled above with minute spots and streaks of cream colour and pale red. The tail is forked, and all the feathers composing it, with the exception of the two middle ones, are barred with white nearly to the

tip, where they are crossed by a broad white band; the first five primaries of the wing are also marked with a broad white band, and there is a triangular spot of white on the throat. The gape is destitute of bristles. The night-hawk is met with in all parts of the United States, and also in Canada and Nova Scotia, where it appears to be very abundant. In its habits it agrees with the other members of its family. The name night-hawk is somewhat inappropriate; for it presents no resemblance to a hawk, nor does it fly by night. It is seen most generally pursuing its insect prey about sunset. Its flight is rapid and sustained. In the autumn this bird is much esteemed for food.

NIGHT-HERON (*Nycticorax*) is a genus of birds belonging to the Heron family (Ardeidae). The Common Night Heron (*Nycticorax griseus*) is an inhabitant of the warmer and temperate parts of Europe, Asia, and Africa, and is occasionally met with in Britain, principally in the southern counties. It is about 2 feet in length, and has a shorter and thicker bill, a stouter body and shorter legs than the true herons. The back of the head is adorned with some slender variegated white plumes; the top of the

head and back of the neck are black; the back is black, with a greenish tinge; and the whole lower surface is white. This bird, like the bittern, is nocturnal in its habits, and frequents marshes, fens, and the borders of lakes and rivers, where it conceals itself among the rushes, reeds, and other herbage. Unlike the bittern, however, it builds its nest on a tree, and is gregarious like the common heron. The eggs, four in number, are pale greenish-blue. Its food consists of frogs, fishes, and aquatic insects. The North American Night Heron (*Nycticorax naevius*) or Qua-bird, is a nearly allied species, and is regarded by some as identical. Four other species have been recognized, one of which, *Nycticorax megacephalus*, peculiar to Rodriguez, has become extinct since that island was colonized.

NIGHT-INGALE is the English name for the most celebrated of the song-birds of the Old World. This well-known species (*Daulias luscinia*) is one of the warblers (Sylviidae), and so is nearly allied to the hedge-sparrow, gold-crest, &c. The plumage is dull and inconspicuous, being reddish-brown above and grayish-white below, with the tail reddish.

The nightingale, or night singer, is a migratory bird,



Nightingale (*Daulias luscinia*).

visiting us about the middle of April, and leaving about August or September. The male birds arrive first, and are instantly sought after by the bird-catchers, who generally make the most of the interval of ten days or a fortnight that elapses before the arrival of the females, well knowing that those males which are taken after they have paired seldom survive. The bird-fanciers have a notion that a Surrey nightingale possesses the finest quality of tone. To dwell upon the richness and variety of its song, a subject which has employed the pens of poets of all ages and of all countries where the bird is known, would be superfluous. The nightingale commences singing a few days after its arrival, and continues till the young are hatched, about the middle of June. Contrary to the prevalent opinion, at least among poets, it is the cock alone which sings.

In our island the nightingale is chiefly confined to the south-eastern counties. It is unknown in western Devonshire, Cornwall, North Wales, and the counties north of Doncaster in Yorkshire. It never visits Ireland, nor do any remain in Brittany or in the Channel Islands. In no part of Europe is it more common than in Spain or Italy;

but even in these southern regions the bird is migratory—Africa being its temporary abode during the months of winter. The islands of the Greek Archipelago are among its favourite localities.

The nightingale haunts woods, thickets, and gardens, and though it does not shun the proximity of man, yet from its inconspicuous plumage and unobtrusive habits its note is heard by far more frequently than the singer himself is seen. Its food consists chiefly of worms, insects and their larvæ, but also of fruits, as currants and elderberries. The nest is placed very near the ground, and is carefully shrouded from observation. It is composed of a mass of dried leaves, straw, grass, and sticks loosely put together, the inside being lined with fine roots and bents. The eggs, from four to six in number, are of an olive brown colour. Besides this exquisite songster, there is another European species, the Thrush Nightingale (*Daulias philomelo*), which, however, is far inferior in vocal accomplishments to the true nightingale, though its voice is loud. It is a larger species, faintly mottled on the breast. It is unknown in England.

NIGHT-JAR. See GOATSUCKER.

NIGHTSHADE is a name commonly given to the plant known to botanists as *Solanum nigrum*. It is an annual herbaceous weed, growing in waste places, and attaining to a height of about a foot. It has white flowers, black berries, and ovate leaves, and thus differs from the Woody Nightshade or BITTER-SWEET, which has a perennial shrubby stem, purple flowers, red berries, and cordate or hastate leaves. Like other species of the genus *Solanum* it possesses narcotic properties, and is looked upon with some suspicion, though the leaves are used in some parts in the same way as spinach. The Enchanter's Nightshade is Cereus. For Deadly Nightshade see ARROW.

NIHILISM is the name given to certain extreme revolutionary doctrines which of recent years have gained many adherents, more particularly in Russia. The word is not a new one, Royer-Collard and Victor Hugo having both used it as synonymous with scepticism; but it was the Russian novelist Turgenev who first used it to designate a philosophical and socialistic movement which arose in Russia about the middle of the present century.

Alexander Herzen is sometimes said to have been the originator of Nihilist principles, but he was only one of a band of workers who, having imbibed in Germany extreme socialistic views, endeavoured to introduce them in a much more advanced form into Russia. Herzen was born in Russia in 1816, and in 1835 was exiled for two years to Siberia as a revolutionist and socialist. Returning to Moscow, he soon afterwards left his native country and lived from time to time in England, France, and Italy, watching events, and eagerly waiting for a general revolution that should be the forerunner of a new era. It was a time of political and social ferment, and the revolution in Paris in 1848 was hailed by many of the advanced school as the commencement of a vast European movement. In a short time, however, it became evident that the change of government in France had produced merely a political republic, and not a socialist one, socialism finding in the new republic stronger opposition than had been presented by the government of Louis Philippe. The trivial result in the way of social change produced by political movements, seems to have filled Herzen and his friends with despair. To them society, as it is at present organized, seemed worthless, and they began to encourage wild dreams of a grand carnival of destruction in which the old order should disappear altogether, so that a new one might be raised out of its ruins. Herzen exclaimed, "Let the old world perish! Welcome chaos and destruction! Welcome death; make room for the future!" And these exclamations may be taken as the epitome of the faith of his subsequent life. In 1851 he founded a printing establishment in London, for the purpose of printing all sorts of political documents and papers to be distributed in Russia; and in 1857, with the assistance of a friend named Ogareff, he commenced in London a Russian newspaper called the *Kolokol* (bell). His intimate acquaintance with many persons of note, who were secret adherents of the new party, enabled him to obtain private information of great value and of every description; while his sparkling wit, his biting satire, and his clear, elegant, and brilliant style procured him a large number of readers. He seemed to know everything that passed, not only in the public acts of the government, but even in the emperor's private cabinet, and every abuse that came to his knowledge he nailed without pity to the pillory. The paper was rigorously prohibited by the censors of the press, but in spite of their efforts thousands of copies of every issue found their way into Russia, the emperor himself receiving it regularly.

Herzen died in 1870, and although there is some reason for believing that his own extreme views were a little modified prior to his death, the views of his followers still found their best expression in his words written in 1848:—"Liberty will have no peace till all that is religious and

political has become simply human and submissive to criticism and negation. It is time to cite the legislation and the republic before the tribunal. There will be many condemnations to death. It will be necessary to sacrifice all that is most intimate and dear. We are not called to gather the fruits, but to be the executioners, of the past, to persecute it, to judge it, to recognize it under every mask, and to immolate it to the future. Our work is to demolish all faiths, to remove existing hope in what is old, and to destroy all prejudices without concessions or mercy."

The working of these principles soon became recognized in Russia, but it was not till 1860 that their advocates became known by the name of Nihilists, they having then been so designated by Turgenev in his work "Fathers and Sons." The unspeakable corruption and oppression engendered by absolutism in Russia had awakened strong feelings of disgust and abhorrence in the minds of thousands of thoughtful young men and women, one result being that they imbibed with avidity the novel and revolutionary theories promulgated by Herzen and those associated with him. The first struggles were directed against everything which appeared to hinder the free development of individual life, the church and religion being the first object of attack. As in the previous century the selfishness, intolerance, and ignorance of many of the clergy prepared the way for the scepticism and atheism which preceded the French Revolution, so the same qualities in the Russian clergy, combined with their adherence to absolutism, caused religion in Russia to be regarded as a pernicious influence and an obstacle in the way of human well-being. In the words of a modern Nihilist writer at the period indicated, "Atheism excited people like a new religion. The zealous went about, like veritable missionaries, in search of living souls, in order to cleanse them from the 'abomination of Christianity.' Some pushed their ardour so far as to carry on the propaganda among the young pupils of the schools." The atheistic literature of France and Germany was translated into Russian, and where printed books could not be obtained the aid of lithography was called in, and such works as could not be openly sold were secretly circulated among educated Russians everywhere. Uneducated Russians have ever been famous for their religious zeal and fanaticism, and it would seem that the same national characteristics are displayed among the educated classes in their enthusiastic acceptance of the crude materialism advocated by certain of the thinkers of Germany. But it was not only religion that the men of the new school proposed to assail, the revolt extended also to social and family life. Here is one programme signed by eighty-four members of a Nihilist alliance in 1868:—"The alliance declares itself atheist. It desires the abolition of worship, the substitution of science for faith, and of human for divine justice; the abolition of marriage, as well as of all political, religious, judicial, and civil institutions. It wishes for political and economical equality of classes and individuals of both sexes, beginning by the abolition of the law of inheritance. It declares that all state powers and authorities now existing ought to disappear in the universal union of free agricultural and industrial associations." In their zeal for destruction some of the Nihilists sought to renounce art in all its forms as one of the manifestations of idealism, and it was gravely asserted "that a shoemaker is superior to Raffaele, because the former makes useful things, while the latter makes things that are of no use at all."

For a long period Switzerland formed the real nucleus of the new movement, and the young male and female students of Russia who went there to complete their education were indoctrinated with the principles of socialism, many of them becoming members of the Internationale. On their return to Russia they sought to spread their principles among the peasantry and workmen, large numbers of them resigning all their advantages in the social

scale in order to become propagandists. The mass of the Russian population being without education, personal teaching was the only means open to the Russian socialists, and so many of them became workmen or workwomen and laboured among the poor in order to spread their principles among them, until at last the government, becoming thoroughly alarmed at the spread of the movement, began arrests on a wholesale scale. An organized attempt at an insurrection in one province was detected and frustrated in 1877, but the danger thus narrowly escaped led to a fierce persecution of the Nihilists, and punishments of terrible severity were inflicted upon all who could be discovered. In return the revolutionists began to resort to assassination and terrorism, and several police spies and officials were shot in different parts of the country. Attempts were also made upon the lives of some of the officials of higher rank, and the life of the Emperor Alexander II. was threatened. Nor was the threat an idle one, for the emperor was fired at as he walked in the streets of St. Petersburg; a mine was dug under the railway line by which he entered Moscow, and a train which was mistaken for that by which he travelled was blown up; in 1880 a portion of the Winter Palace was destroyed by dynamite; and finally, on 13th March, 1881, the emperor was mortally wounded by a bomb thrown at his feet by some Nihilists as he was returning from a review in St. Petersburg. Most of the conspirators directly concerned in this attempt were subsequently arrested, tried, and executed, and desperate measures were resorted to by the police to stamp out the conspiracies, but the revolutionists contrived to maintain their organization and continue their propaganda in spite of every effort made to suppress them. Immediately after the assassination of Alexander II. the executive committee of the revolutionary party issued from their secret press a printed address to his successor, demanding a general amnesty for all political offenders, the convocation of a National Assembly elected by universal suffrage, complete freedom of the press, of speech, of public meeting, and of electoral address, in return for which they promised to refrain from violence, and to submit unconditionally to the decisions of the Assembly.

This address, as might be expected, received no response from Alexander III., and though many persons independently of the Nihilists expected that on his coronation (which was delayed until 27th May, 1883) he would introduce some administrative changes, he has continued to maintain up to the present the absolutism of his predecessors. He has, however, been compelled throughout his reign to take the most extraordinary precautions against assassination, and though the conspirators have been outwardly quiet it is well known that they are busily engaged in propagating their principles, while some of their leaders have publicly intimated that they still retain their belief in the efficacy of terrorism.

(See "Nihilism and the Nihilists," translated from the Italian by Henry Bellenger, Paris, 1880; "Underground Russia," translated from the Italian, London, 1883; and "Russia under the Tsars," London, 1885. The last two works are by an avowed Nihilist, who writes under the pseudonym of "Stepniak.")

NIJ'NI-NOVGOROD or NISCHNEI-NOVGOROD, that is, Lower Novgorod, a government of Central Russia, bounded N. by Kostroma, N.E. by Wiatka, E. by Casan, S.E. by Simbirsk, S. by Perm, S.W. by Tambow, and W. by Wladimir. The area is 19,800 square miles, and it has a population of 1,271,564. The inhabitants consist chiefly of Russians, Tschuwashes, Mordwins, Tscheremisses, and some Tartars. The country is very fertile, and consists of an undulating plain, diversified only by the high lands along the banks of the rivers and by small elevations. The soil consists in a great measure of sand, with a mixture of good earth, and in many places it

is covered with a thick layer of black mould; here and there clay is found, with portions of iron or ochre. The principal river is the VOLGA, which enters the government from Kostroma, and flows thence to Casan in a semicircular bend. This great river in its course through the government receives the Oka, Kulma, Kirsencz, Sura, Werlugo, and Alatyr. The manufactures are numerous and prosperous.

NIJNI-NOVGOROD, the chief town of the above government, is only worthy of notice on account of its great annual fair, opening on the 27th July, and at its height from the 18th to the 27th August, when the population, normally about 40,000, rises to 300,000, or even a larger number, and the sandy tract of land between the VOLGA and the Oka, connected with the town by a pontoon bridge, is covered with trading booths, hotels, lodging-houses, churches, theatres, pleasure resorts, and boulevards, and long streets teeming with a busy crowd, including representatives from almost every nation of the earth, and exhibiting an inconceivable assortment of Asiatic and European merchandise, though it is worthy of notice that hardly a sample of foreign goods producible by Russian industry is anywhere to be seen. The most important merchandise is tea, chiefly brought overland from Northern China. The exhibition of other manufactures and products, such as iron from Siberia, malachite and lapis lazuli, gold and silver work, and precious stones from the Caucasus, and carpets, silks, and shawls, is bewildering in quantity. In September all this begins to disappear, and the Kremlin, the citadel of the straggling town, during the winter looks down on what has become little more than a deserted marsh. The town dates from 1222, and mention of its fair occurs, it is said, in 1366, since which epoch its celebration has suffered very rare and only violent interruption, and it is not difficult to understand why it should have been for so many years, and should be still, so extensively favoured by the world's trade. Nijni-Novgorod lies at the very centre of that water communication which joins the Caspian and Black Sea to the White Sea and the Baltic, and which, were it always summer, might almost have made Russia dispense with roads and railways. And it is, besides, the terminus of the railway from Moscow, 276 miles distant. That line places its fair in communication with all the lines of Russia and of the western world, while the Volga, with its tributary, the Kama, leads to Perm and the pass of the Ural Mountains, and the vast regions of Siberia and Central Asia. Nijni-Novgorod is thus the link between the two great continents, the point of contact between Asiatic wealth and European industry, and its fair the best meeting-place for the interchange of commodities between the surrounding nations.

NIKAN'DROS, one of the ancient Greek poets, whose only remaining works treat of medicine, one of venomous animals, and the other of poisons, in poems of hexameter verses. He flourished apparently in the middle part of the second century B.C. His works have not much poetical merit, but are curious to the physiologist. He had a great reputation in antiquity, was often quoted by other writers, and was a very voluminous author.

NIK'E, the Greek goddess of victory, whose temple on the Akropolis at Athens was one of the glories of the ancient art, is represented usually as a small figure with wings, bearing a palm or wreath. Often a commander bears a small *Niké* in his hand; or the goddess is shown inscribing a tablet of victory to the memory of the general.

NIKEPHOROS, Patriarch of Constantinople in 806 (deposed 815), was originally the secretary of the Emperor Constantine V. (*Kopronomos*), and used his means of access to the archives wisely in constructing one of the best histories of the Byzantine period that remains to us. The period he covers is from 602 to 770.

Another *Niképhoros* (*Kallistos Xanthopoulos*) was the author of a somewhat voluminous ancient ecclesiastical

history, and lived between 1400 and 1450. Most of his work still exists.

NIKIAS, the unfortunate Athenian general whose estimable character has gained him the pity of succeeding ages for his hard fate, began his career with every promise of success. Rich, aristocratic, and capable, he was the friend and colleague of Periklēs, and later one of the chief checks upon the mischievous Kleon. His very caution, which eventually ruined him, at first stood him in good stead, and he gained many victories in the earlier part of the Peloponnesian War. It was to these successes, and to his skill as a diplomatist, that the peace, called the Peace of Nikias, was signed in 421 B.C.

In 415, in spite of the earnest remonstrances of Nikias, the Athenians resolved to start a new phase of the great contest for supremacy by undertaking a great expedition to Sicily. Nikias and Alkibiades were named joint commanders, but the recall of the latter left Nikias in sole command. He proceeded in his cautious way, and the fall of the great city of Syracuse was certain when suddenly Gylippos arrived from Sparta and besieged Nikias in his own lines. Nikias fell ill, sent hurriedly for reinforcements, which arrived only to be hopelessly beaten, and he lingered before Syracuse, unwilling to give up the siege and hoping for dissension to break out in the beleaguered city. At last, when he finally consented to break up the camp, an eclipse of the moon led him to postpone the departure, and caused his utter ruin; for the Syracusans seized his ships and cut him off from the sea, and when he sought to escape by land in some disorder he was overpowered and the whole army captured. Of 40,000 who set out from Syracuse scarcely a man escaped, and the power of Athens was broken for ever. The unhappy captives were driven into the great stone quarries, and there supplied with scanty food; many died of their wounds, many of starvation, many of the exposure to the noontide sun and the night-chills. The place became so horrible in a short time that the miserable survivors were dragged forth and sold as slaves, and the pollution was with difficulty stayed. Nikias and his second in command were put to death by a decree of the city of Syracuse, much to the regret of the Spartan conqueror, Gylippos.

NIKOLAI'EFF, the principal naval arsenal of Russia on the Black Sea, from which it is distant 42 miles, situated near the junction of the Tugul and the Bug. It has a most convenient harbour, but vessels drawing more than 20 feet have to lighten before crossing the bar at Otchakoff, a town at the entrance of the river, which is protected by a powerful fort constructed on an artificial island commanding the channel. The town is a straggling, uninteresting place of about 80,000 inhabitants, but unusually well provided with educational establishments and a great trading place, exporting wheat, rye, barley, and linseed, and importing coals, iron rails, and machinery.

Nikolai'eff was founded in 1790, and intended as the station for the Euxine fleet. At the entrance of the Liman, on the east and west, are the fortified towns of Kinburn and Otchakoff; the former was destroyed by the allied British and French fleets, 17th October, 1855.

NIK'OLSBURG or **NIKLASBURG**, a town in Moravia, in the circle and 27 miles S. of Brünn, and about 50 miles N. of Vienna, is only interesting for its castle, boldly situated on a rocky height in the very centre of the town, and strengthened by lofty towers. Within its walls the terms of the convention between Prussia and Austria were finally discussed and arranged on the 26th July, 1866, by one Prussian and two Austrian plenipotentiaries. These preliminaries were afterwards confirmed by the treaty of Prague, which was signed on the 23rd of August, 1866.

NIKOMEDES, King of Bithynia, a state of Asia Minor which lay along the Sea of Marmara, the Bosphorus, and the Black Sea, was the first to raise this province to

any considerable power. He founded, in 264 B.C., the capital, Nicomedeia, at the north-east corner of the Gulf of Astacus (now Gulf of Ismid), which quickly became one of the most splendid cities of Asia; and later on was a favourite residence of Diocletian and of Constantine the Great. It was here that Hannibal came to die and Arrian was born.

NIKOMEDES II. (*Epiphanēs*) reigned from 149 to 91 B.C., and was the grandson of the grandson of the preceding. He made war against his father Prusias, backed by the Roman republic, took him prisoner and had him executed, thus succeeding to his throne (B.C. 149).

NIKOMEDES III. (*Philopatōr*) reigned from 91 to 71 B.C. He, like his father Nikomēdēs II., suffered much at the hands of Mithradates, the great king of Pontus. He was twice expelled from his kingdom, and twice restored by the force of Roman arms. He bequeathed his kingdom, as he died without heirs, to the Roman people (B.C. 71), a bequest which had very far-reaching consequences, for while it consummated the glory of Rome, it confirmed her in that career of Eastern conquest which eventually was one of the main factors in her downfall.

NILE (*Gr. Νεῖλος*), one of the largest rivers of the globe (having a total course of about 3,400 miles, and draining about 900,000 square miles) and one of the most celebrated, flows from the great equatorial lake called the Victoria Nyanza, discovered by Captain Speke in 1858, the tributary streams to which reservoir may be considered as the ultimate sources of the river. The Nile, known also in this portion as the Somerset or Victoria River, overflows from the north side of the Victoria Nyanza by the Ripon Falls, 12 feet high, and turns north-westward, said at times to expand soon after in a series of lagoons or marshes. Emerging from these the Victoria Nile forms the Karuma Falls at Fowcra; and further down the Murchison Falls, where, in a space of 15 miles, the river descends fully 700 feet. It then joins the Albert Nyanza lake, which has been described as a great backwater of the river. Issuing from the Albert Nyanza, the river is navigable for nearly 100 miles to the bend of Duffi, where rapids interrupt its course. At the Fola or Mekadi Cataract, in 3° 40' N., the river contracts between mountains to less than 100 feet wide, and rushes through a narrow ravine. As far as the stations of Regief and Lado (opposite the old station of Gondokoro), lat. 5° N., the river is almost unnavigable. Thence to Lake No (lat. 9° 30' N.) the river, now known as the Kir or Bahr-el-Jebel, flows through a level country, with many branches and loops. At Lake No it is joined from the west by the group of tributaries which form the Bahr el Ghazal, and turns due east to where it is joined by the Sobat River from the mountains south of Abyssinia. Here the Nile, now called the Bahr-el-Abiad (White River), bends north and flows 500 miles between Sennar and Kordofan to Khartoum, where the Bahr-el-Azrek (Blue Nile) or Abai joins it from Lake Tzana or Denben, in Abyssinia. At Khartoum the river is 1250 feet above the sea. Its course is now north-east to the confluence with its last tributary, the Atbara, which rises as the Takazze in the northern highlands of Abyssinia. From this point, during its great bend through Nubia and down into Egypt to the Delta, a distance of over 1200 miles, its course is through the arid deserts; it receives no affluent, and consequently decreases greatly in volume from evaporation. Below Cairo the river opens out into its delta branches, the largest being those of the Danielta and Rosetta mouths. The Delta, the richly cultivated plain of Egypt, occupies a space more extensive than Wales.

The river is easily navigated from the delta branches up to the first or Assouan cataract in 21° N., but the ascent of that rapid is difficult. The second, or Wady Halfa Cataract (22° N.), is the head of the free upward navigation of the Nile for large vessels; and a railway is con-

structed thence along its banks to El Ordeh in Dongola, where the river is again navigable to the important station of El Dabbek, at the terminus of the shortest caravan route to Darfur. The cataracts of the Nile are more akin to rapids than to waterfalls; they are formed by numerous ledges and points of rock rising above the water, and rendering the passage dangerous. The craft most generally used on the lower Nile is a very long boat with a huge triangular sail. The current of the river is rapid, being from 2 to 3 miles an hour in Upper and Middle Egypt and Nubia; the average fall below the first cataract is said to be from 2 to 3 inches in the mile. The waters of the Nile are always muddy, and the mud is said to be mostly that of the Bahr-el-Azrek, which is of a reddish colour, that of the Bahr-el-Abiad being white. Depending on the rains, the Nile varies in volume very greatly during the year. At Cairo the rising begins in mid June; and when it has swelled to a height of 16 cubits in mid August, the ceremony of cutting the *khafeeg*, or dam, near Cairo, is performed, allowing its fertilizing waters to fill the system of canals which cover the Delta. The maximum rise is generally reached in October, after which the flood begins to fall, and the lowest state occurs again in May. The river enters Egypt proper at Assouan, with a width of 3900 feet; above Cairo the breadth is 2900 feet; the Rosetta mouth is 1800 feet; that of Damietta only 800 feet. These are the only two mouths at the present time, though ancient writers mention seven.

From the earliest recorded times the question of the sources of the Nile has been a fascinating problem among philosophers and rulers. The remarkable properties of the Holy River, such as the regularity of its overflow, the fertilizing influence of its inundation, the sweetness and salubrity of the water, contributed to fix attention upon it and rouse curiosity respecting its origin. Both Alexander the Great and Ptolemy Philadelphus contemplated the solution of the problem; and Lucan ascribes the same design to Julius Cæsar, whom he represents thus speaking at the feast of Cleopatra:—

"Yet still no views have urged my arduous more,
Than Nile's remotest fountains to explore;
Then say what source the famous stream supplies,
And bids it at revolving periods rise;
Show me that head, from whence since time began
The long succession of his waves has run;
This let me know, and all my toils shall cease,
The sword be sheathed, and earth be blessed with peace."

Seneca tells us that the Emperor Nero despatched two centurions fruitlessly upon the mission. Poets indulged in vague conjectures, while not a few resigned themselves to the conviction that by the will of the gods the veil was not to be removed from the sources of the mighty stream.

It was known to the ancients that the Nile proper is formed by the junction of two main branches, which takes place near the modern town of Khartoum, in Upper Nubia. The east branch, or the Blue River, descends from the Abyssinian highlands, and is the Nile of classical geography and of Bruce. But the west branch, or the White River, is the principal arm and main body of the stream, the source of which had remained obscure to this period, though not without many attempts to reach it by ascending the current. Mr. Linant, in 1827, passed up to a considerable distance above the confluence. In 1841-42 an expedition under D'Arnaud and Sabatier, fitted out by Mohammed Ali, pasha of Egypt, advanced along the channel to within 3° 40' of the equator, or to a distance of 3200 miles from Alexandria, following the windings. It was there found to be still a broad stream, containing many islands, and coming apparently from a great distance in the interior. It was not until a new route was tried (owing indirectly to missionary enterprise) from the almost unknown east coast that the head waters of the great "Father of Floods" were destined to be

reached. The information collected by some German missionaries at Mombas led to the belief that there was a series of vast lakes at a distance inland, and it was while engaged on an expedition to explore these that Speke, after discovering Lake Tanganyika with his companion Captain Burton, during the illness of the latter made his way to another large expanse further to the north, now called the Victoria Nyanza; and returned from its shores with the full conviction of its being the great reservoir from which the White Nile derived its waters. This conviction was fully confirmed when, in his second important journey of 1860-63 in company with Grant, he returned to Lake Victoria Nyanza, travelled round its western shore, saw the White Nile issuing from its northern extremity, learned of the existence of Lake Albert Nyanza under the name of the Luta Nziye, and pursued the valley of the Nile until he triumphantly emerged at Gondokoro.

On the occasion of this journey referred to Speke and Grant left the east coast in October, 1860, disappeared in the wilds of the interior in September, 1861, and nothing was heard of them until the pithy telegram was received at the Foreign Office, London, May, 1863, "The Nile is settled." The journey was performed on foot, and involved a walk of 1300 miles, but the splendid result of this expedition was the discovery of the head waters of the Nile. From the middle of the northern boundary of Lake Victoria Nyanza, the parent stream of the Nile was seen to issue, with a width of 400 yards, leaping over a fall. In the course of this cataract, now known as Ripon Falls, there are four distinct falls, separated from each other by bush-covered islands rising about 30 feet.

The great supplement to Captain Speke's discoveries was afforded by Sir Samuel Baker, who, with his heroic wife, in 1863 moved up the Upper Nile route, which Speke had just descended, though not altogether on the same line, struck the great lake Luta Nziye, which he named Albert Nyanza, coasted along it for 60 miles, and discovered that the Nile, after issuing from Victoria Nyanza, falls into the former lake close to its northern extremity, and issues out of it towards the north. Livingstone, whose great desire was to discover the ultimate sources of the Nile in the lakes that have really proved to be the sources of the Congo, though he suspected the truth, died in 1873 without settling the question, and it was not until Stanley, in 1875, circumnavigated the Victoria Nyanza that no doubt was left that this noble inland sea is the great source and head water of the Nile, although the Kitangule, a considerable stream on the western side of the Victoria, is a feeder of the lake. But there is a multitude of streams which also fall into the Victoria Nyanza, and, collectively, contribute immensely more to the volume of the lake than the Kitangule alone. It would seem, therefore, to say the least, not perfectly correct to regard any one tributary of Lake Victoria as the original source of the Nile. It would be more correct to say that the great river is derived from the whole basin of the Victoria, which, with the 21,500 square miles of the lake itself, occupies an area of no less than 90,000 square miles. The total length of the river from the Victoria Nyanza is 3300 miles.

NILGIRI HILLS (Blue Mountains), a district and range of mountains in Madras, often spelt *Nilgherry*. The length of the district from N. to S. is 29 miles, width from E. to W. 51 miles, and the pop. in 1881 was 50,000. It is bounded on the N. by Mysore (Mairûr), on the E. by Coimbatore District, on the S. by portions of Malabar and Coimbatore, and on the W. by Malabar. Situated as these hills are at an average elevation of 6000 feet, equidistant from two seas, sharing two monsoons, and isolated from mountains of similar height, they possess a climate which, for equability of temperature, for mildly invigorating qualities, for great salubrity, and for immunity from the disturbing influences common to the climate of most hill stations, is almost

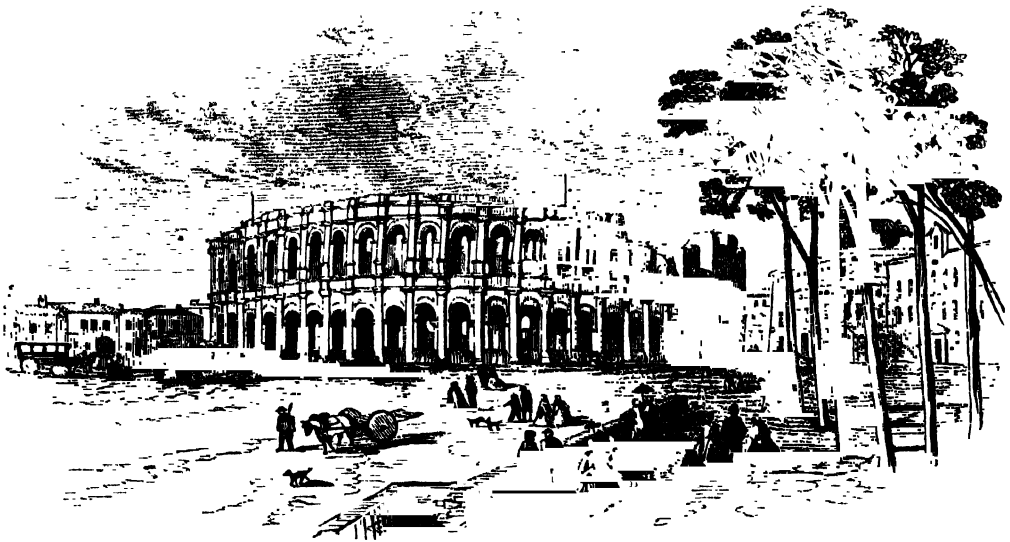
unrivalled within the tropics. The average temperature deduced from the mean of twenty-five months has been fixed at 58° Fahr. The hottest season is in April and May, but its occurrence depends upon the character and period of setting in of the south-west monsoon. The extreme range of temperature, from sunrise to 2 p.m., averages commonly 16° Fahr. throughout the year.

NILOMETER, an instrument resembling our tide-gauges, which is employed in measuring the periodical rise of the Nile. It consists of a graduated column, erected on the island of Er-Rodâh, and standing in a species of tank, which communicates with the river.

NIMBUS, in sacred art, is the name given to the disc or halo which surrounds the head of the sacred personage represented. The sign is one of great antiquity, and it is found in connection with the religious systems of India, Egypt, Greece, and Rome. In its oldest known form it was the attribute of the Egyptian sun-god Re, and afterwards of the Greek Apollo. It was appropriated by Christian artists about the fifth century, and later it became an indispensable adjunct of all representations of divine or saintly persons. In its ordinary form it is circular or semicircular, though the nimbus of the Eternal Father is

sometimes in the form of a triangle, this shape being a symbol of the Trinity, and where all the persons of the Trinity are represented the halo is occasionally caused to assume the shape of a cross. The nimbus of the divine persons is always of gold, and gold is generally employed also for that of the Virgin Mary. Some artists, however, have represented the Virgin with a coloured nimbus, and saints are often depicted with a coloured instead of a golden halo. One ingenious painter is said to have marked his figure of Judas by giving it a *black* nimbus. Further distinctions are found in the use of an inclosed cross to designate Christ, a disc without a cross to denote a canonized saint, and a halo of radiating lines to mark one of the *beati*—persons exalted by the church as worthy of imitation, but not canonized. The analogous forms of the nimbus are the “aureole,” a halo surrounding the entire person, and the “glory,” which, by the best authorities, is applied to the union of both the aureole and nimbus.

NIMES or **NISMES**, capital of the French department of Gard, stands at a short distance from the right bank of the Gard, at the head of a branch line to Alais, 30 miles north-east of Montpellier, and 150 miles S.S.E. of Paris, situated in a delightful plain at the foot of hills covered



Amphitheatre at Nîmes.

with vineyards and olive-gardens. The town is actively commercial, producing silk and cotton goods, possessing also print and dye works, and trading in the oil and wine produce of Languedoc. It has a cathedral and fifteen churches and a fine library. But the prime feature of the city is the number and extent of its remains of antiquity as the *Nemausus* of the Romans. They include a large amphitheatre in which bull-fights are occasionally held, a Grecian temple in very pure style, ruins of a Nymphæum connected with adjoining baths, two of the original Roman gates and the Pont du Gard, a magnificent aqueduct of three tiers of arches spanning a rocky valley in the neighbourhood, which conveyed the water of two springs to the ancient citizens. The population of Nîmes in 1882 was 63,552.

The amphitheatre is in form an ellipse, the major axis of which, extending from east to west, is 431½ feet in length, and the minor axis 337½ feet, including the thick-

ness of the walls. The inclosing structure consists of a lower and an upper story, each pierced by sixty arcades; the whole is surmounted by an attic, the summit of which is 70½ feet high. The amphitheatre was capable of holding 24,000 spectators. It was built with great solidity without cement.

Nemausus is supposed to have been founded by a colony of Phocians; it was subjugated by the Romans, *anno* 121 B.C. In the middle ages it passed successively to its own viscounts, the counts of Toulouse, and the kings of Aragon, by one of whom it was ceded to Louis IX. in 1258. It is the birthplace of Guizot, Nicot (the introducer of tobacco into France), Villars, Jean Fabre, &c.

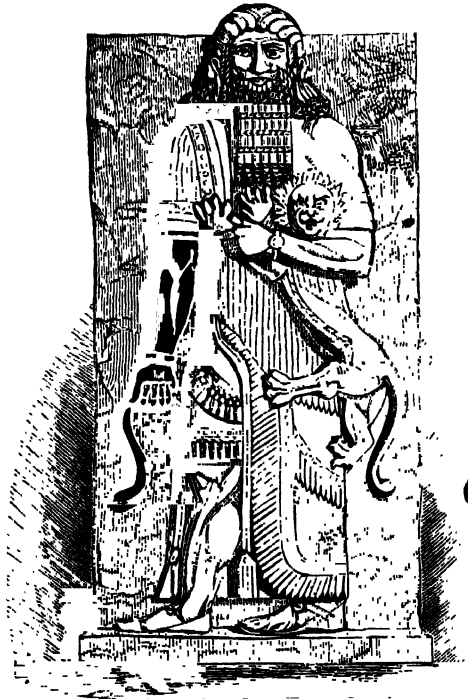
NIN'VEH, called by the Greeks and Romans *Ninus* (Gr. *Ninos*), the capital of the Assyrian Empire, was situated in the plain of Aturia, on the Tigris. The Hebrew and Greek writers concur in describing it as a very large and populous city. Jonah speaks of it as “an exceeding

great city of three days' journey" (Jonah iii. 3). Its walls are described by Diodorus as 100 feet high, and so broad that three chariots might be driven on them abreast. They were strengthened by 1500 towers, each 200 feet in height, and the whole was so strong as to be deemed impregnable. (Nah. ii.) According to the Greek writers Ninus was founded by a king of the same name. It was the residence of the Assyrian kings, and is mentioned as a place of great commercial importance; whence Nahum speaks of its merchants as more than the stars of heaven (iii. 16). The city was overthrown by the Medes under Cyaxares, and the Babylonians under Nabopolassar, about 625 B.C., and its empire merged in that of Babylon.

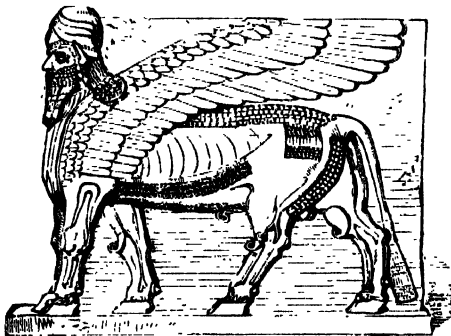
Until modern times there was great uncertainty as to the actual site of Nineveh. Niebuhr and Rich pointed out mounds of ruins which they supposed to mark its locality; and subsequently the elaborate researches of Layard and Botta have settled the point. M. Botta, French consul at Mosul, began his explorations near that city in 1843, in an inclosure in the river Tigris, which had long been conceived to be the ramparts of Nineveh, but which are now supposed to have contained only the palace of the Assyrian kings. He shortly, however, directed his attention to Khorsabad, a village distant about five hours north-east from Mosul. Here his discoveries of walls, bas-reliefs, inscriptions, and sculptures were very considerable. A still greater addition to our knowledge of Nineveh was made by Layard, who spent a large portion of time in the country, and who showed the probable relation which the ruins at Khorsabad bore to those in other places on or near the banks of the Tigris, and by a series of explorations carried out among the ruins by Mr. George Smith of the British Museum. This gentleman, by persevering studies of the cuneiform inscriptions on the Assyrian relics at the Museum, gave to the world the key to the inscriptions in arrow-headed or wedge-shaped characters, the significance of which had previously been obscure and mysterious. See CUNEIFORM.

Unshapely mounds on the left bank of the Tigris, opposite Mosul, are now clearly identified as the ruins of Nineveh and Nimroud. The mounds of the latter represent the Assyrian city of Calah, founded by Nimrod, but afterwards destroyed, and rebuilt about 885 B.C. Among the mounds of the former, lying in a bend of the Tigris, on its eastern side, with the tributary river Khosr running across it, are

intensely interesting additions to biblical history that modern times have furnished. The most valuable "find" was a series of tablets giving the complete Chaldean account of the deluge, an account which comes nearest to the scriptural narrative of anything yet brought to light. There were also found a small tablet of Esarhaddon, king



Nimrod.



Winged Bull from Nineveh.

the most conspicuous ruins of the far-famed city, these being the remains of a magnificent wall about 8 miles in circuit. The mounds embracing the wall are in some places 50 feet high; and in the space that had been occupied by the city, in the palace of Sennacherib, were found a large number of tablets with cuneiform inscriptions, which, when translated, afforded some of the most remarkable and

of Assyria; some new fragments of one of the historical cylinders of Assurbanipal; and a curious fragment of the history of Sargon, king of Assyria, relating to his expedition against Ashdod, mentioned in the 20th chapter of the book of Isaiah; and a tablet bearing a succinct account of the conquest of Babylonia by the Elamites, 2280 B.C.—no less than 4157 years ago. In 1879 a rich discovery was made in the mound of Balawat. Here, in a series of gates and other portions of a magnificent temple, were found complete accounts of the conquests of King Assurnazirpal (B.C. 885-869), and other Assyrian records dating back to B.C. 1120. These most interesting works of Assyrian art are in the British Museum. The ruins cover a space about 18 miles in length along the river, and extend about 12 miles from its left bank, thus occupying an area of over 200 square miles.

NINGPO', a city of China, and one of the treaty ports open to foreign trade, is on the Takia or Ningpo River, here crossed by a bridge of boats. It is surrounded by a fine plain, covered with villages and water-courses, is 6 miles in circumference, inclosed by walls 25 feet in height, and entered by six gates. The population is estimated at from 250,000 to 300,000, who are principally engaged in the manufacture of silks—for export to Japan—in junk-building, and in an extensive trade in all the chief products of the Chinese Empire.

Ningpo has an excellent harbour. The imports consist chiefly of cotton goods, metals, and opium, and the exports of tea and silk. The largest trade is with Great Britain. On the opposite side of the river is a foreign settlement, where the British consul resides and a few foreigners carry on trade. Ningpo was taken by the British without resistance in 1841, when a ponderous bell, now in the British Museum, was captured. In December, 1861, it was seized by the Taiping rebels, and held until May, 1862, when it was recaptured by a British naval force, aided by a body of disciplined Chinese. Ningpo affords the unique instance of an Anglo-Chinese force of police being maintained by the Chinese authorities. The mission societies are well represented, and have residences and chapels chiefly within the city walls. The climate of Ningpo is very similar to that of Shanghai, but the river water is salt. The surrounding country is mountainous and attractive. The centre of the city is ornamented with an elegant seven-storied hexagonal tower—the “heaven-bestowed” pagoda—160 feet in height. From its summit there is a magnificent view of the city and surrounding country.

NINON DE L'ENCLOS (or *Leuclos*). See **L'ENCLOS**. **NINTH**, an interval in music, and the chord taken upon the dominant, tonic, or supertonic of the key with that interval for its limit. [See **DISCORDS**, **FUNDAMENTAL**; **INTERVAL**.] The chord of the Ninth may be major or minor, according to the quality of its Ninth; but in both forms alike the Third is always major, Fifth perfect, and Seventh minor. Like all fundamental discords it may be taken without preparation. The interval of the Ninth falls to the root (*i.e.* the octave) or rises to the Third of the root (*i.e.* the Tenth); or in certain cases, not very common, it remains while the rest of the chord changes; and in the first of these resolutions (on the octave to the root) the root itself should not appear at the same time as the Ninth in any of the upper parts. Similarly in all inversions of the chord of the Ninth, the root is omitted. In using the *major* Ninth, that interval should always be kept above the Third of the chord, consequently the last (fourth) inversion is unavailable when it is desired to resolve the Ninth upon the root of the chord. A few resolutions of the chord of the Ninth are given below.

MINOR NINTH. First Inversion.

Resolved on root, on Third.

MAJOR NINTH.

Resolved on root, on Third, on another chord.

The treatment of the chord does not essentially differ in any of the three degrees of the scale upon which it is taken.

The inversions of the minor Ninth form a very extraordinary series of chords. It is perfectly easy to modulate by their means, in usually one progression only, or at the most in two, from any one key to any other key. The chord is the very Proteus of music. A few examples of this may be given below. The reason is that the same notes in any given inversion of a minor Ninth may spring from no less than four different roots, since each of them

Root G, Root E, Root C#, Root B.

(First inv.) (Second inv.) (Third inv.) (Fourth inv.)

is exactly a minor Third from its neighbours, and the whole chord when the root is omitted has a complete vagueness of tonality, as shown in the illustration; and further, each

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of these roots may be a dominant, a supertonic, or a tonic, that is, may belong to either of three major or minor keys. For instance, the first chord, root G, may be on the tonic of G, on the dominant of C, or on the supertonic of F. Of course the names of the notes have to be changed to suit the various keys; but they are enharmonically the same notes, and are produced by the same digitals of the pianoforte.

C to F C to D C to A \flat C to E \flat C to B

Modulations by Minor Ninth. *i.e.* &c.

the dominant of C, in its first in , through

Diatonic chords of the Ninth can be taken on any note of the scale; and are composed of the notes of the scale not inflected. These discords must be prepared and resolved; and their resolution is always on to a chord whose root is a fourth above the root of the (diatonic) Ninth. As the root is omitted in all inversions of the Ninth, since it may never appear in an upper part, it is clear that the first inversion of a diatonic Ninth is note for note the same with the root position of a diatonic Seventh; the second inversion of a diatonic Ninth with the first inversion of a diatonic Seventh, &c. The chords are only distinguished by their resolutions, as of course the root on which such a Ninth will resolve is a third below that on which the Seventh will resolve. The composer decides whether to treat the chord as the one or the other.

NIOBE, in the Greek mythology, was a daughter of **TANTALOS**, and sister therefore of **PELOPUS**, both names as fateful as her own. She married **AMPHION**, king of Thebes. Her six sons and six daughters were reckoned the loveliest children ever seen; and in her overweening pride at her good fortune she once scornfully spoke of the goddess **LÉTÔ**, who had borne but two. Upon this **PHOIBOS** (**APOLLO**) and **ARTEMIS**, the two divine children of **LÉTÔ**, came down to **Mount Sipulos** in **Lydia** (**Asia Minor**), where **Niobë** and her children were staying with the queen's father **Tantalos**, and there they slew the whole family one by one with their arrows, **Phoibos** killing the boys, **Artemis** the girls. The youngest child clung to the half-frantic mother, who sought to protect it; but when at last the fatal shaft reached its mark, and **Niobë** was childless, her heart turned cold as stone, and she stood silently, the tears coursing down her cheeks. Standing long thus she was transformed into veritable stone, the snow melting on the top of which trickled down the rocky face in never-ending tears. The rude limestone effigy cut in the rock is still to be seen, and is still weeping, at **Mount Sipulos** near **Ephesus**.

The origin of this pathetic legend is not yet clear. Whether it arose from a chance resemblance in the rock of the hill-side to a seated woman, and this was afterwards improved by art, or whether the legend came first and the art-work afterwards (if so grand a name can be applied to so rude a work), and whether the legend followed the artist for its *locale* or *vice versa*, we cannot determine. Many sites, European and Asiatic, are mentioned, besides the chief one of **Sipulos**. Many rock-cut **Niobës** are also found in **Asia Minor**—so many, indeed, as to hint at some extra-Grecian origin of the whole matter. For one thing, **Max Müller** has shown that **Niobë** is a form of the ancient word for *snow* in the **Aryan** tongues; and of course snow melts under the fierce arrows of the sun and his sister, that is, the sunbeams, while the beautiful icicles, children of the snow, dissolve away in tears, so that only the bare rock is left at last.

One of the finest productions of antique art is the large

group of marbles at Florence, representing Niobé, her children, and their pedagogue or governor, all in admirably-conceived attitudes of fear or death. The original arrangement seems to have been in the triangular pediment of a temple, but the details of this still exhaust the ingenuity of the learned. Pliny says the statues were in his day attributed to Skopas or Praxitéles. Modern judges award them to the former. The Florentine statues are not originals but very clever copies, and were found buried at Rome in 1583.

NIObium or **COLuMBium**, a rare metal obtained from columbite; it was discovered by Hatchett in 1801. It is also found associated with uranium, yttrium, and other rare metals in the samarskite of Siberia, in tantalite, in pyrochlore, and in pitchblende. It is obtained from the fluoride by heating it with sodium in an iron crucible, and washing out the soluble salts with water; the metal remains as a black powder, having a specific gravity of 6.56. The symbol is Nb; the atomic weight is 98. When heated in the air it is oxidized to niobous oxide (Nb_2O_3).

It is soluble in hydrochloric acid and hydrofluoric acid, but not in nitric acid, which has no action on it. Fusion with potassium carbonate converts it into niobate of potassium. It forms two oxides, niobous oxide (Nb_2O_3) and niobic oxide (NbO_2). The former is a dense white powder, which becomes yellow on heating, and which, in the anhydrous state, is insoluble in all acids; it has acid properties, and forms definite salts with the alkalies and metals, called niobates; one of these is found native, as columbite, which is a niobate of iron and manganese; another, samarskite, is the uranioniobate of yttrium and iron. Niobic oxide is in the hydrated form niobic acid. It is a dense white powder, turning yellow when heated. It forms a number of salts with the alkalies and metals; some of these are found native, as pyrochlore, which is a niobate of calcium and cerium. There are two chlorides of niobium, niobous chloride ($NbCl_3$) white, and niobic chloride ($NbCl_5$) yellow. There are also two fluorides of similar constitution.

Niobium is detected by the insolubility of the oxides in acids after ignition, and by giving with microcosmic salt before the blowpipe a violet coloured bead in the inner flame, which becomes colourless in the outer flame.

NIOR'DER (or *Njorðr*), with Freyer and Freya, his son and daughter, forms a curious interpolation into the Norse mythology. He is not one of the Ases (gods), but one of the Wanæs; and a contest is spoken of between the Ases and Wanæs, in which the latter were beaten, and Njörðr, Freyer, and Freya given as hostages for their future submission. This is exactly parallel to the contest of Titans and Olympians in the Greek mythology; and just as it happened in many cases with the Greek gods so also did Njörðr and his children finally enter the ranks of their opponents as their equals, receiving worship with them.

Therefore the same explanation is now very generally received for both—namely, that Titans and Wanæs represent the gods of the indigenous people; Olympians and Ases those of a conquering people; and that in certain individual cases the worshippers of the older gods made good their claims to adoration.

Njörðr is represented as the "prince of men," tall and stately, wise, good, and rich; the patron of agriculture, the ripener of fruits, and the protector of commerce, especially of navigation; loving the dash of waves in a calm sea, and the song of swans (*i.e.* the death-song), and such gentle and peaceful sounds, but averse to storm and noise. His consort, Skadi, was a great huntress; but as she did not love the ocean, and he was soon tired of the woods, after some time they agreed, still remaining good friends, to separate.

NIORT, the capital of the French department of Deux-Sèvres, situated on the Sèvre-Niortaise, at a distance of 255 miles south-west from Paris, and had 19,840 in-

habitants in 1882. The town is situated in a delightful and well-cultivated district, and is built on the slopes of two hills, and on both sides of the river. The town-hall is a very ancient building, once the palace of Eleanor of Guienne, wife of Henry II. of England. There are two churches, one of them an ancient Gothic building with a fine spire raised by the English, a college, cavalry barracks, and an ancient castle, the birthplace of Madame de Maintenon. The other public buildings include two hospitals, a theatre, library (containing 30,000 volumes), baths, geological museum, atheneum, learned society, &c. The town has a botanical garden, two good squares, and a pleasant promenade near the barracks. The chief manufactures are chaums and other leather, gloves, shoes, woollen and cotton yarn, druggets and other woollens, iron goods, saddles, braces, horn combs, paper, saltpetre, and confection of angelica. Considerable trade is carried on in cattle, wines, staves, timber, corn, flour, wool, and hair. The navigation of the river Sèvre commences at Niort.

NIPA (*fruticans*) is a prostrate palm, growing in mud flats on the sea-shores of tropical Asia. It is of great value to the natives, for the feather-like leaves, often 20 feet long, are used for thatching, the leaf-stalks for framing and flooring their huts, a decoction is applied to wounds, while salt is obtained from the ashes. The fleshy flower-stalks (spadix) supply a large quantity of sweet liquid "toddy," from which they obtain sugar, spirit, and vinegar. The female flowers are clustered at the end of the spadix, and are succeeded by nuts forming balls as large as a man's head. The seeds, which are solitary in the nuts, are edible, and afford oil by pressure. Sir Joseph Hooker in his "Himalayan Journal" speaks of this plant thus:—"Every now and then the paddles of the steamer (at the mouth of the Ganges) tossed up the large fruits of *Nipa fruticans*, a low stemless palm that grows in the tidal waters of the Indian Ocean, and bears a large head of nuts. It is a plant of no interest to the common observer, but of much to the geologist, from the nuts of a similar plant abounding in the tertiary formations at the mouth of the Thames, and having floated about there in as great profusion as here till buried deep in the silt and sand that now form the Island of Sheppey." These fruits are called nipadites by geologists. The genus is rather anomalous, having some relationship to the screw-pines (*Pandanus*); there is but one species. See **PALME**.

NIPHON' or **NIPPON'**, the principal island, which gives its name to the Empire of JAPAN, lies between 33° 30' and 41° 40' N. lat., and in 130° 40' E. lon. It is of a crescent shape, convex to the S.E., and is about 850 miles long, and from 100 to 150 broad. It lies in the line of volcanic action which extends from Java to Kamtschatka, and is traversed throughout its length by a mountain range some of whose peaks are volcanoes; the highest, Fusi-Yama, being 12,235 feet high, an active volcano, and covered with perpetual snow. The mountains, however, are in general not lofty, and the land is fertile and well cultivated. Earthquakes are frequent; mineral and hot springs are abundant; and gold, silver, copper, and coal are found. Rice, wheat, the sugar-cane, and tea are the principal crops. The chief towns are Tokio (Yeddo), and Kioto (Miako), the two capitals of the empire.

NIERVA'NA. See **BUDDHISM**.

NISI PRIUS. The history and original meaning of this term is given under **ASSIZE**. At present a *Nisi prius* trial means one before a single judge, with or without a jury, either at the sittings held in London and Middlesex or at the assizes. Since the rules of the supreme court of 1883 the ordinary trial at *Nisi prius* is without a jury; actions only, as a rule, being tried in this way. Where indictments or informations are tried at *Nisi prius* a jury is necessary.

NITO'KRIS, the half-mythical Queen of Babylon, to whom Herodotus attributes some of the chief glories of Babylon. Possibly she was the queen of Nebuchadnezzar.

NITOKRIS was also the name of a very famous queen of Egypt, ruling jointly with her brother, or as some say her husband. The young king perished in a revolt, whereupon Nitokris, who was devoted to his memory, assembled the ringleaders to whom he owed his death, and having set them to a banquet in a large underground hall near the Nile, let in the river upon them and drowned them all—a wholesale revenge which won the admiration of the ancients. It was this queen who built the third pyramid, or perhaps rather who faced it with the red syenite slabs which once made it so remarkable and so splendid. (Menkaura, in Greek *Mukerinos*, was probably the builder of this pyramid, and it bears his name.) Nitokris was the last monarch of the sixth dynasty of Egypt, and her reign closed about B.C. 2592. Her beauty is spoken of as almost superhuman.

NITRE, a term usually applied to nitrate of soda, occasionally also to nitrate of potash, which, however, is more commonly known as saltpetre. See POTASSIUM NITRATE; SODIUM NITRATE.

NITRIC ACID. GLAUBER'S SPIRIT OF NITRE, or **A'QUAFOR'TIS**, a strong acid much used in commerce, and known since the eighth century. It was obtained by Glauber from the distillation of saltpetre with oil of vitriol. It is usually prepared on the large scale by heating sodium nitrate with excess of sulphuric acid in iron cylinders; the acid distills over and is condensed in large Woulff's bottles of stoneware. Sufficient sulphuric acid is used to form the acid sulphate of sodium, which is more easily removed from the retort, and furnishes all the nitric acid at a lower temperature. When pure it is a colourless liquid having a specific gravity of 1.52. The formula is HNO_3 . It boils at 86°C . (187°Fahr.), and becomes solid at -55°C . (-67°Fahr.) It is very corrosive, and stains the fingers yellow. It is a most powerful oxidizing agent, and acts upon all metals except gold and platinum, and some of the rarer metals, converting them into oxides or acids. On organic bodies it acts with great energy, oxidizing them into oxalic, acetic, and formic acids, or even into carbonic acid and water. Picric and succinic acids are also common products of its action on organic compounds. In some cases it displaces hydrogen in the compound, substituting NO_2 for it, and forming nitro-derivatives, as nitro-benzene $\text{C}_6\text{H}_5(\text{NO}_2)$ from benzene (C_6H_6), trinitro-cellulose or gun-cotton, $\text{C}_6\text{H}_7(\text{NO}_2)_3\text{O}_9$, from cellulose, $\text{C}_6\text{H}_{10}\text{O}_6$.

Nitric acid is used as a solvent for metals, as in refining of gold and silver, for engraving on copper, and etching on steel. Mixed with hydrochloric acid it forms aqua regia, used for dissolving gold and platinum. It is much employed in the manufacture of nitro-benzene, and in that of oxalic and picric acids, so much used as a yellow dye of great permanence. It is also used in the production of xyloidin for collodion in photography, and in the preparation of celluloid or xylonite; also in making gun-cotton and nitro-glycerin.

Its compounds with bases are called nitrates; these are crystalline salts, soluble in water. Some, as those of potassium and sodium, are found native, and several are important articles of commerce. These are described under the respective metals.

Nitrate of ethyl or nitric ether ($\text{C}_2\text{H}_5\text{NO}_3$) is an inflammable liquid, having a sweet taste, and a specific gravity of 1.112. It boils at 85°C . (115°Fahr.) It is insoluble in water, but soluble in alcohol and ether.

Nitrates are easily detected by their reactions. Sulphuric acid liberates the nitric acid, shown by its freeing iodine from potassium iodide, and by bleaching indigo. The most characteristic test is obtained by adding a crystal of ferrous sulphate to a mixture of a nitrate with sul-

phuric acid; a dark-brown ring round the crystal is at once perceptible.

Medical Properties of Nitric Acid.—Two forms of the acid are recognized in the British Pharmacopœia, one strong and the other dilute, prepared by mixing 2 oz. of the strong with 13 oz. of distilled water. The strong acid is chiefly used as an escharotic to effect the speedy destruction of any part. It is applied by means of a pointed glass rod to phagedenic sores, to destroy warts and some kinds of polypi, or the exposed end of a nerve in a carious tooth, and to cause the destruction of a part bitten by a rabid animal. Largely diluted with water it forms a valuable lotion in many forms of skin disease. The dilute acid is administered internally in doses of from 10 to 30 minims, generally in combination with a bitter infusion, as a gastric or intestinal tonic. From its frequent employment in the arts, nitric acid is often the cause of accidental poisoning, and it surpasses all the other mineral acids in the rapidity of its action. The most appropriate antidote is lime water, or better still saccharated lime water, and failing this, chalk, whiting, or magnesia may be made into a paste with water, and be administered in frequent doses so as to combine with and neutralize the poison.

NITRO-BEN'ZENE or **NITRO-BENZOL**, a nitro-derivative of benzene. It is usually prepared by the action of fuming nitric acid on benzene; it separates as a heavy oil from the mixture. It is a yellow oily liquid of specific gravity 1.186. It has a sweet taste, and a strong odour of bitter almonds; it is used for this purpose by perfumers in scenting soap, under the name of essence of mirbane. The formula is $\text{C}_6\text{H}_5\text{NO}_2$. It boils at 213°C . (415°Fahr.) It is insoluble in water, but soluble in alcohol and ether. Further action of nitric acid converts it into dinitro-benzene ($\text{C}_6\text{H}_4\text{N}_2\text{O}_4$), which is a crystalline substance. Nitrobenzene is now manufactured on a very large scale for the production of aniline, the starting-point of the tar colours.

NITRO-CEL'ULOSE. See GUN-COTTON.

NITROFORM is a colourless oil, having the formula $\text{C}(\text{NO}_2)_3$. At a low temperature it forms colourless cubic crystals. It is soluble in water, and explodes with great violence when heated.

NITROGEN or **AZOTE**, a gaseous element discovered in 1772 by Rutherford. It is called nitrogen from its forming part of the composition of nitre. It forms about four-fifths of the volume of atmospheric air, in which it acts as a diluent of the oxygen. It is widely distributed in nature, being found in the mineral kingdom in the form of nitrates and of ammoniacal salts. It enters into the constitution of all vegetable and animal substances. It may be separated from the air by burning out the oxygen with phosphorus or other combustible body which is capable of combining with it. It is a colourless gas, having a specific gravity of 0.972. It is odorless and inert, and slightly soluble in water. It does not support combustion nor respiration, animals dying in it for want of oxygen. The symbol is N, the atomic weight 14. It has recently been condensed into a liquid, under a pressure of thirty-five atmospheres, and at the low temperature of -146°C . (-231°Fahr.) At this temperature and pressure atmospheric air also becomes a liquid.

Nitrogen combines with chlorine to form the most terribly explosive substance known—the chloride of nitrogen, NCl_3 . It is a heavy yellow oil, having a specific gravity of 1.658. It explodes instantly in contact with any substance of a greasy nature. The explosions are very violent; one drop on a porcelain dish shatters the vessel to fragments. Hydrochloric acid decomposes it quickly, and in this way it has been analyzed, but great danger attends any experiments with it. The iodide of nitrogen (NI_3) is a brown powder, also very explosive; the bromide (NBr_3) is a dark volatile oil, and very explosive. There are five

oxides or oxygen acids of nitrogen: the protoxide or nitrous oxide (N_2O), the dioxide or nitric oxide (N_2O_2), the trioxide or nitrous acid (N_2O_3), the tetroxide or nitric peroxide (N_2O_4), and the pentoxide or anhydrous nitric acid (N_2O_5).

Nitric acid in solution has been already described. Nitric anhydride is obtained by decomposing silver nitrate with chlorine. It forms brilliant colourless crystals, which melt at $30^\circ C.$ (86°Fahr.) and boil at $45^\circ C.$ (113°Fahr.)

Nitrous oxide (N_2O) is a colourless gas of specific gravity 1.495. It is usually obtained by heating gently nitrate of ammonium in a flask; the salt is converted into water and nitrous oxide,

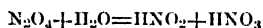


The gas has an agreeable odour and sweet taste. It is liquefied at a temperature of $-86^\circ C.$ (-123°Fahr.) and a pressure of 50 atmospheres. Its specific gravity is 0.908; at $-100^\circ C.$ (-150°Fahr.) it becomes solid. Nitrous oxide is slightly soluble in water, also in ether and the oils. It is much used in dental and other minor operations for producing anaesthesia, and is supplied by the manufacturers for this purpose compressed into iron drums. When only slightly inhaled it produces intoxicating effects and hilarious laughter, often inducing great muscular efforts; whence its common name of laughing gas.

Nitric oxide or linoxide of nitrogen (N_2O_2) is obtained by acting on copper shavings with nitric acid; it is a colourless gas of specific gravity 1.039, and is slightly soluble in water. Nitrous acid (N_2O_3) is usually obtained by the action of nitric acid on starch. It forms a blue liquid, which is liable to change, and acts both as an oxidizing and a reducing agent. For instance, it oxidizes indigo and reduces chromic acid. It forms salts with bases called nitrates and having the general constitution MXO_3 .

Nitrite of ethyl or nitrous ether ($C_2H_5NO_2$) is a very soluble yellow inflammable liquid, with an odour of apples, having a specific gravity of .898 and boiling at $18^\circ C.$ (64°Fahr.) It is slightly soluble in water, but the solution decomposes on keeping. It is the active ingredient in the well known medicine called sweet spirits of nitre, so much used as a stimulant, diuretic, and diaphoretic.

Nitric peroxide or peroxide of nitrogen (N_2O_4). This oxide forms the dense orange fumes when nitric oxide is mixed with air; it can be obtained in colourless prismatic crystals at $-9^\circ C.$ (16°Fahr.); just above this temperature it becomes a liquid having a specific gravity of 1.451 and a greenish-yellow colour. At $22^\circ C.$ (72°Fahr.) it becomes orange-yellow and boils. The vapour is very suffocating, and cannot be respired. It is decomposed by water into nitrous and nitric acids, as in the following equation:—



Nitrogen is generally recognized from the total absence of active properties, and it is estimated by measurement of the residual gas after all the others have been removed by various reagents. In organic compounds it is usually converted into and estimated as ammonia by combustion with soda-lime.

NITRO-GLYCERIN or **GLON-OIN** is a nitro-derivative of glycerin, an explosive substance much used as a substitute for gunpowder. It was discovered in 1817 by Sobrero, and is prepared by adding glycerin in small successive quantities to a mixture of one measure of nitric acid of specific gravity 1.43, and two measures of sulphuric acid of specific gravity 1.83. The vessel containing the acids is immersed in a cooling mixture during the addition of the glycerin, when an oily amber-coloured fluid is produced, insoluble in water, inodorous, possessing a sweet pungent flavour, and highly poisonous. A small drop placed upon the tongue produces a violent headache of several hours' duration. The formula is $C_3H_5N_3O_9$ or

$C_3H_5(NO_2)_3O_3$, or glycerin $C_3H_5O_3$, in which three equivalents of the hydrogen are replaced by NO_2 . It has a specific gravity of 1.595. It detonates when struck, and explodes when heated with terrible violence. Potash decomposes it, forming glycerin and potassium nitrate. It is also decomposed by sulphides, the best method of destroying its explosive power and rendering it inert. Common alkali waste has this effect.

The first to attempt its use as an explosive agent was a Swedish engineer named Alfred Nobel. He found, in 1864, that the shock produced by the explosion was ten times greater than that of the strongest blasting gunpowder. On the other hand, nitro-glycerin is dangerous from concussion in a degree not observable with gunpowder, and many most fearful accidents have thus been caused by it; the liquid also, when poured into the bore-hole, has frequently run into some unknown crevice, and when fired has produced an explosion under the very feet of the miners. To obviate this in some degree cartridges have been employed which do not quite fill up the bore-hole; but in this case a portion of the explosive force is wasted.

Under whatever light it is viewed nitro-glycerin is the most perilous explosive known—poisonous to handle, emitting noxious fumes after ignition, capable of easy explosion by decomposition, a moderate heat (300°Fahr.), an incidental spark, friction, or concussion, even a trifling agitation of a small quantity in a bottle held in the hand is highly dangerous; and, moreover, it possesses the properties of solidifying at a very moderate temperature (10°Fahr.), and in that condition of being much more liable to accidental explosion.

To remove many of the dangers, particularly of concussion, associated with the use of nitro-glycerin, M. Nobel, in 1870, invented a preparation called *dynamite*, which now, when properly made, constitutes one of the safest, most convenient, and most powerful explosive agents applicable to industrial purposes. Dynamite is made by mixing nitro-glycerin with a porous infusorial earth known in German as "Kieselguhr." The earth absorbs the oil, and the result is a plastic putty-like substance, of a brick-dust colour, containing about 75 per cent. of nitro-glycerin and 25 of absorbent earth. This burns without explosion when placed in a fire or brought into contact with a lighted match. If struck with a hammer on an anvil the portion takes fire without inflaming the dynamite around it; and if packed with moderate care it may be transported by road, railway, or canal with little danger of explosion either from heat, spark, friction, concussion, or collision.

Such conditions of safety, however, entirely depend upon dynamite being properly made. If the kieselguhr is not properly dried and prepared, so as not only to absorb, but to permanently hold in absorption the nitro-glycerin mixed with it, exudation is apt to take place; and if this only occurs to the extent of a thin greasy layer over the surface, there are present all the dangers of nitro-glycerin pure and simple. Good kieselguhr, thoroughly prepared, will hold as much as three times its own weight of nitro-glycerin, but the greatest care is necessary to prevent its exuding from over-saturation. The method of firing it is by means of a copper capsule containing fulminate of silver, and when thus exploded its effects are very little less powerful than those of pure nitro-glycerin. This arises from the fact of the compound being solid instead of liquid, enabling the full force to be developed. There are the advantages of its being of a pasty consistence, so as to fill bore-holes without the dangers attending a liquid, and no cartridge case is necessary.

Lithofracteur is, practically, dynamite under another name. It generally consists of nitro-glycerin, sandy earth, powdered coal, sulphur, sawdust, and nitrate of soda, or nitrate of baryta. These preparations of nitro-glycerin are in considerable favour on the Continent in military opera-

tions, but the researches of Mr. Abel and others have conclusively shown that, for such purposes, GUN-COTTON possesses an enormous advantage as regards safety, while fully equal in explosive power. Dynamite is, however, the favourite explosive in all blasting operations, and it is manufactured on a very large scale in this country. With the view of solidifying the nitro-glycerin, and yet retaining its full explosive powers, it has been mixed with gun-cotton, and the preparation introduced under the name of blasting gelatin. It is the strongest explosive known, but somewhat uncertain in its action and very dangerous to handle, and therefore it has not superseded dynamite.

By an Act passed in 1875, packages of nitro-glycerin, or of any preparations of the same, must be legibly labelled as "explosive," and special precautions were imposed, under heavy penalties, upon persons engaged in its sale or carriage.

Nitro-glycerin has recently been introduced into medicine, especially in angina pectoris, for which it is at present the only remedy. It is also used in neuralgia, asthma, seasickness, and Bright's disease. It occasions a violent headache, but patients are said to get accustomed to it and scarcely notice it. It is taken in doses of $\frac{3}{64}$ grain to $\frac{1}{16}$ grain, and the effects are felt two minutes after taking the dose. For medical use it is dissolved in almond oil, and made into tablets with chocolate.

NITRO-MURIATIC ACID or **AQUA REGIA**, a mixture of nitric and hydrochloric acids used for dissolving gold and platinum.

NITRO-PHTHALENE, a compound obtained by acting on nitro-naphthalene with caustic potash. The formula is $C_{10}H_7(NO_2)$. It forms yellow crystals, insoluble in water, but soluble in alcohol, ether, and oils. It melts at $48^\circ C.$ (118° Fahr.), and boils at $280^\circ C.$ (536° Fahr.)

NITRO-PRUSIDES or **NITRO-FERRICYANIDES**. These are ruby-coloured salts, crystallizing with great facility, and characterized by the splendid purple colour, which they give with alkaline sulphides. These compounds are formed by the action of nitric acid on the alkaline ferro- or ferri-cyanides. Their general formula is $M_2Fe_3C_7N_6(NO)$.

NITRO-SACCHAROSE, a white bitter resin, formed by the action of fusing nitric acid on cane sugar. It melts at $30^\circ C.$ (86° Fahr.), and explodes when heated. It is insoluble in water, but soluble in alcohol, ether, and oils.

NIXE, the general name for female water-sprites in the Norse mythology and Teutonic legends, with a masculine *nixe*. The word is often used in English as *nixie*; and as with the continental *nixen*, the *nixie* is usually mischievous and sometimes malevolent, luring men to a watery grave with their songs, singing and combing their long hair mermaid-fashion. Sometimes the nixies were capable of kind actions, however, and by means of their powers of prophecy gave timely warnings. They were usually credited with the power of assuming the form of a horse, in evident reference to the "horse-tamer," the epithet applied to Poseidon and Neptune in the Greek and Roman mythologies. Our common word for the devil, "Old Nick," is derived from this root, traceable through all the Teutonic tongues (Old English *nicor*, Icelandic *nykr*, Danish *nök, nisse*, &c.)

NIZAM'S DOMINIONS. See HYDERABAD.

NIZZA. See NICK.

NOBILITY, a term used in a general sense to mark a distinction of rank in society by which a class of men are raised above the condition of the mass of the people. Etymologically, as naturally, it means the *known ones*, the renowned; from *no* (or in Greek *gno*), the root of the verb *noscere* (or in Greek *gignosko*), to know, with the adjectival form *bilis*. The renowned men of the tribe were the first nobles. Wherever we meet with organized society we find inequalities of rank and condition, and men once raised above

their fellows naturally seek to transmit the advantage to their descendants, so that in nearly every civilized or semi-civilized society we find some form of *hereditary* nobility. In a narrower sense the term is used to designate a precedence in society or government founded on hereditary succession or bestowed as a gift by a sovereign. In ancient Rome the earliest nobility, that of the patricians, seems to have represented the descendants of the original founders of the city, the plebeians being the descendants of allies or conquered tribes who had been incorporated with the Roman people, but who had not been admitted on equal terms. To maintain their supremacy we find that the patricians monopolized all the important offices in the state and in connection with the national religion, and further that they maintained as long as they were able numerous unjust and oppressive laws designed to strengthen their order and to keep the plebeians in submission. In course of time in the conflicts which necessarily arose between the two parties, the patricians were deprived by degrees of nearly all their exclusive privileges, and in their place a new nobility was formed, the members of which derived their precedence from the fact that their ancestors had filled high offices in the state. All those who could point to forefathers ennobled by office were entitled to the *jus imaginum*, or the right of having images of their ancestors; and in course of time these families formed an order of nobility, and developed a spirit of exclusiveness almost as intense as that which had prevailed in the patrician order which had been superseded.

At Athens, also, the earliest nobility was founded upon the circumstance of first settlement, and the Eupatridæ represented an older stock of citizens round whom others had gathered, and who as an order were quite as proud and exclusive as the patricians of Rome. With the growth and development of the power of Athens the nobility were gradually deprived of all their exclusive rights and privileges, and when the democracy had attained its full growth all the offices of state were theoretically thrown open to every citizen without any reference to birth. At the same time it is evident from the history of the Athenian state that long after the Eupatridæ were placed in a position of legal equality with the rest of the citizens, they retained much social and political influence, and the votes of the citizens in the election of officers of state were generally given to men of noble birth.

In the history of the Teutons the earliest reference to their institutions extant speaks of an existing division of the people into the three ranks of noblemen, freemen, and bondsmen. It is further evident that this division had prevailed from a very remote period, from the legend preserved in the *Rigmæl-saga*, in which the Jarl, Karl, and Thrall are represented as being the offspring of three separate acts of creation. A somewhat similar myth, developed among the Hindus to account for their own divisions of society, is noticed under CASTE. In the absence of written history it is not easy to say what was the origin of the Teutonic order of nobility, or what were its special characteristics and privileges; but it is clear that after the overthrow of the Roman Empire the old *eorlas*, deriving their rank from immemorial usage, gave way before the rise of the thegns or personal adherents of the conquering chiefs. In the new order of things brought about in the formation of new kingdoms out of the ruins of the old empire, personal service was of more importance than the accident of birth, and while there was nothing to prevent an earl becoming a thegn, the way was opened for the rise of men of valour and capacity from the ranks of the freemen as well. The origin of the feudal aristocracy of Europe is indicated in the fact that nearly all the titles adopted are derived from military service. Thus, *dux* or duke, a term of Roman origin, implies the duty of leading the armies of the country; count or *comes*, also of Latin

origin, implies government of a district, its Teutonic equivalent being *graf*; and *marquis* or *markgraf* is a term originally used to describe a commander intrusted with the guardianship of a coast-line or inland boundary. [See also the articles *BARON*, *COUNT*, *DUKE*, *EARL*, &c.] Originally fiefs or grants of land were given only by sovereign princes, but in course of time the tenants began to exercise the power of subinfeudation, and thus a lesser order of nobility arose, the members of which owed allegiance to their superior lord, as he owed allegiance to the sovereign, a further development being the allotment of lands to persons who were bound to render in return a knight's service to their superior. The connection between nobility and the holding of land is further illustrated in the practice by which the lord assumed a territorial name from his castle or the chief place within his domains. In this way the prefix *de* in France and *von* in Germany have become badges of nobility. In England the preposition gradually fell into disuse, while many of our most illustrious names are of other than territorial origin.

By the policy of William the Conqueror the practice of subinfeudation was abolished, and the king compelled both his barons and their vassals to take the oath of fealty to himself, so that every man became a "king's man." Some of the Saxon thegns became barons under the new *regime*, while others were thrust down into a secondary rank of freeholders, and thus became the country gentlemen and yeomen who were for a long period the backbone of English society. During the twelfth century the introduction of HEREDITARY and its reduction to a system did much to define and mark out the noble class throughout Europe. Granted for distinguished service, or as a recognition of superior rank, by the sovereign, the coat of arms passed to all the descendants in a direct line from generation to generation, and on the Continent all who were entitled to use coat armour were recognized as belonging to the nobility. A different usage prevailed in England, where the acquirement of political power by the greater nobility, and the formation of the peerage, left the younger members of the great families simply commoners. These, though entitled by good right to the use of coat armour, were not regarded as forming part of the nobility, but became simply English gentlemen. E. A. Freeman, the historian, writing on this point observes, "There can be no doubt that the class in England which answers to the *noblesse* of other lands is the class that bears coat armour, the gentry strictly so called. Had they been able to establish and maintain any kind of privilege, even that of mere honorary precedence, they would exactly answer to continental nobility."

The higher nobility of England, or the peerage, consists of the five temporal ranks—duke, marquis, earl, viscount, and baron, to each of which is attached a hereditary seat in the House of Lords. Peers of Scotland and Ireland, who are not also peers of Great Britain or of the United Kingdom, can only sit in the House of Lords by election, the Scotch peers being entitled by the Act of Union to elect sixteen of their number to represent their body in the House of Lords each Parliament, and the peers of Ireland being entitled to elect twenty-eight of their number to sit in the House of Lords for life. A Scotch peer who is not one of the sixteen representative peers is debarred from sitting in the House of Commons, but this disability does not extend to Irish peers. All peers of Great Britain or of the United Kingdom have a seat in the House of Lords. No Scotch peer has been created since 1707, the Act of Union being understood to debar the sovereign from creating any new Scotch peerages, but a limited creation of Irish peers was allowed by the treaty of Union between Great Britain and Ireland in 1801.

The crown may at its pleasure create a peer, that is, advance any person to any one of the five classes, which is now done either by writ or patent. A peer cannot be

deprived of the dignity, or any of the privileges connected with it, except on forfeiture of the dignity by being attainted for treason or felony, with the exception made by the Act of 1871, that bankrupt peers are disqualified from sitting or voting in the House of Lords. The dignity also must descend, on his death, to others, as long as there are persons within the limitation of the grant, with all the privileges appurtenant to it.

If peers of the realm are charged with any treason, felony, misprision, as principals or as accessories, they are not subject to the ordinary tribunals, but the truth of the charge is examined by the peers themselves. In misdemeanours a peer is tried by jury like a commoner. The lords spiritual are also, in all cases, tried by the ordinary courts. When peers sit in judgment they give their affirmation on honour, but when examined as witnesses they must be sworn.

Women may be peeresses of the realm in their own right, whether by creation or as inheritors of baronies which descend to heirs-general, but they have no seat or vote in the House of Lords. The wives of peers are called peeresses. Peeresses have the same privileges as peers, whether they are peeresses by birth, creation, or marriage, but if a peeress by marriage marry a commoner, she loses her privileges. A peer who has different titles in the peerage, takes, in ordinary parlance, his highest title, one of the inferior titles being given by courtesy to his eldest son. Courtesy titles are also given by common consent to the other sons and daughters of peers. See COURTESY TITLES.

NOBLE, an old English coin, an excellent specimen of which will be found in the gold noble of Edward III., figured in COINS, Plate 4. The famous rose noble of the same monarch, first struck in 1344, is so called from its bearing the Plantagenet device of a rose. The name of the coin is usually said to arise from the purity of the gold of which it was made. Its value was said to be 6s. 8d. at the time of its creation, or rather, to be accurate, the third of a pound, that is, a pound of silver Tower weight (fifteen-sixteenths of a pound weight troy), so that since 20s. were struck from the Tower pound then, and 66s. are struck from the troy pound now, the value of the noble in terms of our own day may be taken as 21s. or 22s.

NOCTILUCA is a genus of infusorian animalcules, which are the chief cause of the phosphorescence of the sea. See INFUSORIA.

NOCTULE (*Vesperugo noctula*) is a common English bat, belonging to the family Vespertilionidae. The noctule or great bat is the largest British bat with the exception of the Mouse-coloured Bat (*Vespertilio murinus*), which, however, has been rarely caught in Britain, and can scarcely perhaps be considered indigenous. The noctule measures 3 inches in length, and its outstretched wings about 15 inches. The head is rounded and broad transversely; the muzzle being short, wide, and abruptly truncated. The ears are broad, ovate, and shorter than the head. The fur is of a reddish-brown colour. The noctule takes up its abode in the hollows of old trees, rarely frequenting buildings. It feeds chiefly on insects, especially cockchafers. It flies high, uttering wild discordant cries. It is widely distributed over the Eastern hemisphere, but does not range further north in England than Yorkshire. According to Gilbert White it is most abundant between April and July. The female produces only one at a birth. The body emits an offensive odour.

NOCTURN (Lat. *nocturnus*, nightly), an office consisting of psalms and prayers, introduced by St. Ambrose, and formerly celebrated in the Romish church at midnight. It is now part of the service of matins, which on Sundays and festivals consists of three nocturns, each nocturn containing three psalms and three lessons at least. The lessons are not always from the Scriptures, but are also drawn from the "Lives of the Saints" and the writings of the fathers.

NOCTURNE, the French term for the class of musical compositions called in Italian *Nocturno*. Nocturnes were originally quiet pieces played, perhaps as serenades, by night, suited to the peaceful stillness of that season by their character. Field, called "Russian" Field, from his long stay at St. Petersburg, appropriated the term for a peculiarly gentle and romantic kind of fantasia for the piano-forte; and Chopin raised it somewhat on Field's lines to an important art-form. The term has been used by certain eccentric painters of late to express night scenes, vague flashes of half-expressed light upon canvases otherwise dark.

NODAL POINTS AND LINES. The former are those points in the length of a string extended between two fixed objects, or in a column of air, which, when the string or column is put in a state of vibration, are found to remain at rest while the "ventral sections" each side of the nodes are alternately vibrating in opposite directions; and the latter are corresponding lines which exist on the surface of an elastic body, usually a plate, whose parts are in a state of vibration.

NODDY (*Anous stolidus*) is a sea-bird nearly allied to the true TERNs, but differing from them in having the wings shorter and the tail less deeply forked. The plumage is of a dark brown colour, with the top of the head buff and the back of the head sooty-gray; the bill and feet are black. Its length is about 14 inches. This bird is found in the warmer parts of the Atlantic Ocean, on both shores of which it is well known, but can hardly be regarded as more than an occasional visitor to the British islands. It feeds upon fishes, which it captures as it skims over the waves. The noddy breeds on the rocky islands of the Atlantic, where it makes its nest with a little seaweed; but on the keys of the Gulf of Mexico, where it is very abundant, it builds a regular nest in a tree or bush. It lays three eggs of an orange colour, with red and purple spots and blotches. Four other species of the same genus are known.

NODES. The point of the ecliptic through which the moon passes when travelling from south to north of that plane, is called the *ascending node*. The point of the ecliptic through which it passes when travelling from north to south of the same plane, is called the *descending node*. These nodes, however, are not to be regarded as fixed, or even as necessarily diametrically opposite each other. They have a considerable proper motion from east to west. Thus the lunar nodes shift their position in a year in a west direction to the extent of $19^{\circ} 20' 19\frac{1}{2}''$. If the point of the ascending node at the beginning of a lunar month be near a certain star, it will be found in the next month nearer to another star further west by $1^{\circ} 33' 49\frac{1}{2}''$.

NODES, in medicine, are certain tumours which arise in connection with the bones, and are a sign of the existence of chronic periostitis. The swellings are rounded or oval in shape, tense and hard in their earlier stages, but after development they become softer and even fluctuating. While forming they are attended with considerable pain, which is usually most severe at night, but subsequently the swelling becomes indolent and painless unless pressed upon. They may form anywhere, but they generally appear along the shin-bone, or the radius and ulna, or on the clavicle and cranium. They may appear as a sequel to typhoid fever, or they may be due to local injury, scrofula, or syphilis, the latter cause being the most common. The treatment must depend entirely on the constitution of the patient and the original cause of the disease.

NODIER, CHARLES, was born at Besançon in France, 29th April, 1780. He adopted literature as a profession at a very early age, published a vast number of works in various branches, was a regular contributor to the *Journal des Débats*, and editor of the *Quotidienne*, two Parisian newspapers. He did everything supremely

well, and yet never achieved a true masterpiece. He is one of the puzzles of genius. Nodier was librarian of the Mazarin Library, and was elected a member of the French Academy in 1834. He died 7th January, 1844.

NODULES, CONCRETIONARY, are more or less rounded lumps of mineral matter occurring in rocks, and differing somewhat in chemical composition from the surrounding mass. They are produced by the aggregation of materials round attracting centres or nuclei—usually buried fragments of decomposing organisms or mineral particles of a different character to the main portion of the deposit—and many (especially of the latter) are strongly suggestive of feeble attempts at crystallization. The nuclei evidently exert their influence in at least two distinct ways; sometimes the process is altogether chemical; on other occasions the aggregation takes place by the operation of crystalline forces; and at other times the two modes of action probably combine to produce the results observed. In certain cases the attracted mineral substances have completely pseudomorphosed the original surroundings of the nucleus, and in this manner have been produced such interesting nodules as those little lumps of crystalline matter, "coal-balls," frequently met with in coal seams; in these, even the microscopical tissue of the carboniferous plants has been mineralized and preserved. But in most cases the pseudomorphism is much less evident even when organic structures are embedded in the concretionary material.

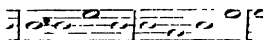
The greatest variety in concretionary nodules appears to be found in fine-grained beds of the nature of clays and shales. *Clay-ironstone nodules* [see IRON ORES] are met with in well-defined layers in certain of the carboniferous strata, and consist chiefly of carbonate of iron, mingled with clayey particles usually attracted round some organic nucleus, such as a fragment of vegetation. They form the most important English ore of iron, and are largely worked in Yorkshire, Derbyshire, Staffordshire, Warwickshire, South Wales, and Scotland. At least half of the iron manufactured in Britain is obtained from these nodules. *Pyrites nodules* [see IRON PYRITES] also occur in abundance in most fossiliferous clays and shales, often exhibiting a radiating structure, and sometimes still inclosing the original organic nucleus: the white variety or MARCASITE seems most commonly to assume this form. In some coal measure localities—especially South Lancashire—they are obtained in large quantities for the manufacture of green vitriol (sulphate of iron). *SEPTARIA* are concretions of clayey matter cemented by a very large proportion of carbonate of lime and fissured internally. *Phosphatic nodules* are rounded masses of phosphate of lime—with a certain amount of carbonate, and also iron—and are often mistaken for CORALLITES, which have approximately the same composition. When ground and treated with sulphuric acid they form a valuable manure.

In sandstones the concretions appear to be mostly ferruginous or calcareous, though silicious nodules are likewise not unknown. Many of these are of enormous size, and the fossil bodies, whose decomposition has given rise to the original nuclei, are often very distinctly seen. Their outward form can frequently be recognized as due to the shape of the inclosed fragment or fragments, especially when the rock exhibits but little stratification, for the presence of bedding tends to cause an elongation of the nodules in the direction of the planes, thus partially obscuring the effects of other influences. In limestone almost all the concretionary structures are silicious or ferruginous. *FLINT* and *CHERT* nodules are examples of the former, while rounded, radiating masses of marcasite represent the ferruginous group, especially in the chalk.

Besides the above, which strictly come under the denomination of concretions proper, it is a common—but erroneous—custom to include other nodular lumps of the same composition as the main mass of the rock, and produced

merely by contraction on consolidating. The latter owe their peculiarities neither to chemical nor crystalline forces, and have been well described as simply "structural developments." We might venture to speak of their centres as *dynamic nuclei*. See also **WEATHERING OF ROCKS**.

NODUS (Lat., a knot), an ancient musical term for what is now called a **CANON**, since this form of musical composition is often written as an enigma, capable too of several answers not seldom. One canon in especial was considered so clever as to have been dignified with the name of *Nodus Salomonis*; it is by Valentinus, and runs thus:



It may be resolved for ninety-six separate voices, in twenty-four choirs, four parts to a choir. Other arrangements have also been suggested raising the number of voices to 512.

After all the whole affair is but one long drawn chord, and the ingenuity which by various devices prevents the voices from copying one another seems to us moderns ill-spent.

NO'EL or **NO'WELL**, an equivalent of *carol*, a corruption of the French *noëlle* or "good tidings," i.e. the gospel. The old carol has it

"Nowells, Nowells, Nowells,
Sing all we may,
Because that Christ the King
Was born this blessed day."

The French are very rich in their "Noels," especially of the sixteenth and seventeenth centuries, many of them almost rising to the form and dimensions of a motet, and there are a few early Italian specimens by Nanini, Marenzio, &c.

NOISE. As the only distinction between a musical tone and a noise lies in the fact that a musical tone is due to periodic and a noise to irregular vibratory motion, it does not seem surprising to find the two words used synonymously among our forefathers, whose ears were less cultivated than our own. Shakspeare frequently uses the word, and often produces an intentionally ludicrous effect, as when one "drawer" cries to the other,

"See if thou canst find Sneak's noise."

II. Henry IV. ii. 4.

Even Milton does not scruple to use the lines

"Divinely warbled voice
Answering the stringed noise,"

in his noble "Ode on the Nativity;" and the Prayer-book version of the Psalms gives us, "God is gone up with a merry noise" (Ps. xlvii. 5). In each case what we now call a chorus or a band is meant by the word.

NOLLE PROSEQUI, a phrase used in proceedings at common law to denote the voluntary withdrawal of the plaintiff or other originating party in a judicial proceeding from the further prosecution of his suit, and is derived from the words used in the formal entry of such withdrawal on the record, in which the party "acknowledges that he will not further prosecute" (*fateretur se ulterius nolle prosecute*). The effect of a *nolle prosecute* in criminal cases is to discharge the defendant for the time, but it does not operate as an acquittal.

In Scotland this phrase is not used. But in criminal cases the public prosecutor may, with leave of the court and before the jury is sworn, "desert the diet," as it is termed, *pro loco et tempore*, the effect of which is that the accused is discharged for the time, but may be and generally is reindicted on a new libel. The public prosecutor may also desert the diet *simpliciter*, without the leave of the court, at any stage of the trial, but in that case a verdict of not guilty will be entered, and the accused will be for ever acquitted. Even after the jury have returned a verdict of guilty the court cannot pass sentence unless moved to do so by the public prosecutor;

and if that motion is not made the prisoner is in like manner acquitted, and cannot afterwards be retried or sentenced for the same offence. These rules apply where indictment proceeds at the instance of the public prosecutor. In the rare and now almost obsolete cases where the prosecutor is a private person, such private prosecutor has less control of the libel, and the public prosecutor, who is associated with him, and the court itself, will see that justice is not defeated by collusion with the prisoner. See **NONSUET**.

NOL'LEKENS, JOSEPH, was born in Dean Street, Soho, London, 11th August, 1737. At the age of thirteen he was placed with Scheemakers, the sculptor, and while with him obtained some prizes from the Society of Arts, which afterwards voted him fifty guineas for his "Timoclea before Alexander." He set out for Rome in 1760, where he remained for some time manufacturing antiques, by finding either heads and limbs for bodies, or bodies for heads and limbs. His dexterity and skill in repairs of this kind were subsequently displayed in some of the Townley Marbles. He became an associate of the Royal Academy, and had numerous commissions for monuments (some of which are in Westminster Abbey). One of his statues is known by the name of the Rockingham Venus. He died 23rd April, 1823.

NOM'ADS, a name given to those nations whose chief occupation is that of feeding and tending their flocks. They retain no fixed habitation, but are continually moving about in search of fresh pasturage. Nomad tribes show a higher grade of civilization than those that live by hunting and fishing, but inferior to those engaged in agriculture and manufactures. The Arabs, Tartars, Bedouins, many tribes in the steppes of Northern Asia, the Lapps in North Europe, in Africa, and some of the Indian tribes of North and South America, are examples of nomads in the present day.

NO'MEN. The Roman gentile (clan) name. See **NAME**.

NOMENCLATURE, CHEMICAL, was originally based on the dualistic theory of Lavoisier in 1787. Considerable changes and modifications, however, have within the last few years been made, in order to adapt the names to more modern ideas, though chemical symbols supply to a great extent in modern chemistry the place of the philosophical names. The names of the elementary substances are necessarily arbitrary. Those known previous to 1787 retain their original names, as *iron, gold, phosphorus, sulphur*, and several others. The more recently discovered elements have generally been named in connection with some chemical property, or some circumstance in relation to their history; as *oxygen*, from the Greek (acid generator), *hydrogen* (water generator), *chlorine* (green), *iodine* (violet), *bramine* (fetid odour). All the names of newly discovered metals have a common termination, *um*, as *potassium, sodium, platinum*; the names of several of the non-metallic elements end in *ine*, as *chlorine, bromine, iodine, fluorine*.

In binary compounds, or those which consist of only two elements, the simple compounds of the other elements with *oxygen* are all termed *oxides*; and to distinguish the different oxides, the Latin (adjectival) name of the element in combination with the oxygen is generally employed, as—

Argentite oxide (Ag_2O). Stannic oxide (SnO_2).

When the same element forms two compounds with oxygen the termination *ic* is retained for the higher oxide, and the termination *ous* is retained for the lower, as—

Ferrous oxide (FeO). Ferric oxide (Fe_2O_3).

Sulphurous oxide (SO_2). Sulphuric oxide (SO_3).

If there are more than two oxides the necessary distinctions are made by means of Greek numeral prefixes:—

Nitrous oxide (N_2O); nitric oxide (NO); dinitric trioxide (N_2O_3); nitric dioxide (NO_2); dinitric pentoxide (N_2O_5).

Carbonic oxide (CO); carbonic dioxide (CO_2).

The names of the *binary compounds* of the other elements are formed like those of oxygen, thus—

Compounds of Chlorine are termed Chlorid	
Bromine	Bromides.
Iodine	Iodides.
Fluorine	Fluorides.
Sulphur	Sulphides.
Nitrogen	Nitrides.
Phosphorus	Phosphides.
Arsenic	Arsenides.
Antimony	Antimonides.
Carbon	Carbonides.

The specific names in the several classes of compounds also follow the analogy of the oxides, as—

Stannous chloride,	SnCl_2 .
Stannic chloride,	SnCl_4 .
Diferrous sulphide,	Fe_2S .
Ferrous sulphide,	FeS .
Ferrie sulphide,	Fe_2S_3 .
Ferrie disulphide,	FeS_2 .

The termination *ide* always indicates compound containing only two elements.

Acids are the most prominent class of compounds of three or more elements; and the greater part of the inorganic or mineral acids are composed of two elements, hydrogen and oxygen, combined with some third element which forms the characteristic constituent in each case, and from which the acid takes its name. As in the case of binary compounds, the terminations *ic* and *ous* are employed to indicate a greater or less amount of oxygen in the compound, thus—

Nitrous acid,	HNO_2
Nitric acid,	HNO_3
Sulphurous acid,	H_2SO_3
Sulphuric acid,	H_2SO_4
Phosphorous acid,	H_3PO_3
Phosphoric acid,	H_3PO_4

In every acid the hydrogen it contains may be replaced by different metallic elements, forming a class of compounds termed *salts*. The generic name of the salt of each acid is formed by changing the *ic* of the name of the acid into *ate*, or the *ous* into *ite*, as

Sulphurous acid forms	Sulphites.
Sulphuric acid "	Sulphates.
Phosphorous acid "	Phosphites.
Phosphoric acid "	Phosphates.
Carbonic acid "	Carbonates.
Silicic acid "	Silicates.

The different salts of the same acid are distinguished as before:—

Nitric acid,	HNO_3
Sodic nitrate,	NaNO_3
Potassic nitrate,	KNO_3
Argentie nitrate,	AgNO_3
Sulphuric acid,	H_2SO_4
Potassic sulphate,	K_2SO_4
Calcic sulphate,	CaSO_4
Mercurous sulphate,	Hg_2SO_4
Mercuric sulphate,	HgSO_4
Ferrous sulphate,	FeSO_4
Ferrie sulphate,	$\text{Fe}_2(\text{SO}_4)_3$

The terminations *ous* and *ic* of these salts indicate the same difference in the condition of the metallic element which determines the union of the metal with more or less oxygen.

The class of compounds called *hydrates* are derived from water by replacing one-half of its hydrogen, thus—

Potassic hydrate,	KOH	from HOH
Calcic hydrate,	CaO_2H_2	" 2HOH
Bismuthic hydrate,	BiO_3H_3	" 3HOH
Silicic hydrate,	SiO_4H_4	" 4HOH
Ferrous hydrate,	FeO_2H_2	
Ferrie hydrate,	FeO_3H_3	

When the hydrogen of an acid is only partly replaced, or is replaced by more than one metallic element, the constitution of the resulting salt may be indicated, as:—

Hydro-disodic phosphate,	HNa_2PO_4
Potassio-aluminic sulphate,	$\text{K}_2\text{Al}_2(\text{SO}_4)_4$

The advantage of the present system of nomenclature is, that it describes the composition of the compound, which is especially valuable in organic bodies. The disadvantage is, that in many cases it involves the use of very long names; we may give as a good example the body known as paramehyliatimmetabromoparatolylinide.

NOMENCLATURE, MUSICAL. is not in too settled a condition at present. The nomenclature of intervals is dealt with under INTERVAL; that of time and expression may receive a few words here.

The notes now used in music bear English names which are quite indelensible in themselves. The *breve* is now a doubly-long note, not a short one—although in the days of its birth it was what its name represents, in relation to the huge and the long of those early times; the *semibreve* may pass as half-a breve, and yet, since it is our principal note, and fills the whole bar in our common time (4-4), it might well have a name of its own; the *minim* is no longer a tiny note; the *crochet* is not now a hooked note; the *quaver* is far more than a mere suspicion of a note, a grace note. But use has taken all these names out of the category of sense, and specialized them. It would be, perhaps, more productive of harm than good to change *semibreve*, *minim*, *crochet*, *quaver*, and *semiquaver* to the French series of *round*, *white*, *black*, *once hooked*, *twice hooked*, &c., or the German of *whole note*, *half note*, *quarter note*, *eighth note*, *sixteenth*, &c. If we were to change, it would certainly be better to change to the latter system, which at once gives a meaning to the time-signatures that at present they otherwise do not possess. Set a practised English musician before a strange time-signature, such as the above, and he will probably be puzzled for a moment; but to him who knows that fractions of a *semibreve* are always used, this sign simply stands for three whole notes (*i.e.* three *semibreves*) in a bar.

Steady attempts have been made by Schumann and other over-nationalized persons in Germany, and by a few foolish musicians in France, and even in England, to alter the nomenclature of expression from the time honoured Italian into the language of the country of the composer. It has been found necessary to translate into Italian some of the worst of the German freaks of this kind. "Imig, leidenschaftsvoll, rasch," &c., are mere stumblingblocks to musicians who know perfectly well what "expressive, con passione, allegro," &c., signify; in fact, Germans themselves would know more clearly what the composer meant if he had used the ordinary (Italian) musical terms.

NOMINALISTS AND REALISTS. This famous controversy of the middle ages rests upon the answer to the following question:—Taking the class of beautiful things, beautiful women, beautiful flowers, beautiful sounds, scents, sights, why is it that they are all called beautiful? The Realist replies, because they share in the possession of beauty; beauty has a real existence, and all beautiful things enjoy a part of it; thoroughgoing Realists would even declare that beauty would exist even though there were no beautiful things. The Nominalist, on the other hand, says

that beauty is an abstraction, a mere name (Lat. *nomen*), and not a reality at all; that it exists not apart from beautiful things, that it is an expression for that quality in which many diverse objects agree, just as soldiers, copper, apples, and rubies may agree in all being red. Redness, however, exists not apart from red things, nor does beauty apart from beautiful things.

Probably there are now few Realists left, but time was when it was quite the other way. The mighty names of Sokrates and Plato raised Realism to almost a religious doctrine; Plato based his whole philosophy upon it. Aristotle stoutly combated the universals of Plato as needless multiplications of existences—Why beyond red things make another existence of redness, beyond beautiful things create the reality of beauty? He denied that there was to be found anything beyond the particulars themselves—these qualities named are mere predicates; that is, he went for Nominalism almost to its fullest extent.

In the middle ages, Scotus Erigena in the ninth century raised the standard of the Platonic Realism, Remigius and others following him. Two centuries later (eleventh century) the battle, which had not ceased to rage, turned to the theological issues, and Anselm, archbishop of Canterbury, maintained from Plato's doctrines that the Trinity could be explained. All men make or contain *man* as a whole, and yet each man is complete as a man, said he, and just so all the divine persons make *God*, and this though each person is himself completely God. Against Anselm Roscellin took up the Aristotelian position and the name of Nominalist, Anselm and his followers taking the name of Realists. Many of the great thinkers refused definitely to belong to either school, like Abelard for instance (1079-1142); and Prantl has counted thirteen well-marked differences of system as regards this subject among the thinkers in the great scholastic revival of thought. A third school of *Conceptualists* grew up, who though they agreed with the Nominalists in denying the reality or existence of the universals (abstractions) spoken of, yet did believe and assert that they might be imagined. They admitted, that is, that there was no beauty really existent apart from beautiful things; but they asserted nevertheless that beauty was separable in thought, was thinkable apart from beautiful things. Such was somewhat the position of St. Thomas Aquinas in the thirteenth century (1226-74), and of Duns Scotus (1265-1308), but with many curious subtleties too deep for elaboration here. At length our famous countryman, William of Occam, let fresh breezes into this musty atmosphere, with a free Nominalism, and under this new life the scholastic philosophy, which was after all but a hothouse plant, began to droop and soon withered away. In less than a century Realism was the suspected doctrine. Eventually men gave up the question, which had got so one-sided, and attacked in preference the allied problem of the origin of knowledge, whether from intuition or experience.

NOMINATIVE CASE. In most of the Indo-European languages nouns, both substantive and adjective, take case-endings to mark their relations to other words in the sentence. The word case (Lat. *casus*), like the corresponding word of the Greek grammarians, *ptôsis*, meant falling; that is, it expressed the manner in which the noun fell upon or rested upon other words. If the noun is the agent, the leader or subject of the sentence, it will be in the nominative case. It has so long been customary to place nouns in the dictionary by their nominative cases, that until somewhat lately the nominative case was held by the public at large, and even by many philosophers, to be the word itself. For instance, *magister*, *hostis*, *rex* were the real Latin words, so nine men out of ten thought, and other cases (as the genitive, for example) were formed from these, as *magistri*, *hostes*, *regis*. But it is now manifest that the real word, if we are to call it so, is that part which is common to all

cases, nominative as well as any other. In the examples named, *magist-*, *host-*, *reg-* are the real words whence the various cases are formed by suffixes. Now, these suffixes were once words in themselves. The nominative suffix *er* is undoubtedly the same with the Teutonic pronoun *er*, he; *is* is the exact Latin correspondent to it, and occurs in *hostis*, and in the shortened form of *s*, in *rex*—that is, *reg-s*. So also the nominative (Latin) *pu-ella* is undoubtedly the pronoun *illa*, that, added to the root *pu-* of the word "youth." The Greek *is*, he, accounts for the Greek masculine nominatives in *-os* and the Latin in *-us*, and the Greek *she* and Latin *ea*, she, for the feminine nominatives in *ê* and *a* in those languages. The nominative is therefore the naming or demonstrative case. *Av-is cauit* means "he" (*is*) "the bird" (*av-*), that bird there, "is singing." The nominative suffixes named as Teutonic or as Greek or Latin, are of course part of the common Aryan stock, and have their Sanskrit and other mutual equivalents, and are chosen here or there not as implying any special Teutonic or Greek or Latin operation in the matter, but simply as the clearest forms for the elucidation of the point at issue.

In our own tongue, at its earliest, we, too, had a clear nominative case, as well as all the other cases. For instance, the nominative *steorra*, a star, had as genitive and accusative *steorran*, and the masculine of the adjective "good" ran *god*, *godes*, *godum*, *godne*, *gode*, in the nominative, genitive, dative, accusative, and ablative cases. In so very many cases, however, the root of the word was the nominative in old English, without suffix, that when case-endings were worn away in our tongue by the constant attrition of time, the nominative remained unaltered in a vast number of instances—an additional reason for careless students mistaking nominatives for roots (or as they have been called above, "real" words) in general. The true view of the matter is that we have now no case-endings in English (unless we except the pronouns, which are not quite instances in point) save only the *s* of the genitive or possessive; in all other situations we use the root of the word and distinguish the case-meanings by the help of prepositions, &c. For the consideration of the general subject, see the article INFLECTIONS.

In English the nominative is now the *absolute case*, and we know it is the nominative by the pronoun being used in the nominative case. We should say, "He being destroyed, paradise must be lost," where the Latin usage would require the ablative absolute (*eo perditto*, &c.), and the Greek usage the genitive absolute. But this was not always so. In the oldest English the dative was the absolute case. Thus Wyclif has, in his New Testament, Matt. xxvii. 21, the dative absolute, "Thei han stolen him, *us sleeping*," and Milton has the well-known passage in "Paradise Lost," where Satan says of the new-created man and his paradise (Book ix. 129)—

"Only in destroying I find ease
To my relentless thought; and, *him destroyed*,
(Or won to what may work his utter loss),
For whom all this was made, all this will soon
Follow." &c.

NON-COMMISSIONED OFFICERS. In the British army, are those subordinate officers of a regiment who are promoted from the ranks, and do not hold the queen's commission, but occupy a middle place between the commissioned officers and the men. The non-commissioned officers comprise the sergeants in the Line regiments, and in the Life and Horse Guards the corporals are also included. They have a mess to themselves, and are entitled to quarters for their wives. Their duties are to overlook the men in barracks and when not on parade, to drill recruits, and assist the officers in every possible way.

NONCONFORMISTS, LAWS RELATING TO. The English Reformed Church first received a definite

constitution in the reign of Edward VI., and from the reign of Elizabeth downward penalties were imposed, or disabilities created, by a want of conformity to the ritual of the Established Church. The Act of Uniformity (1 Eliz. c. 2) forbade, under severe penalties, the performance of divine worship except as prescribed in the Book of Common Prayer, and imposed a fine of 1*s.*, to be levied by the churchwardens on persons who did not frequent the parish church. By a later Act (23 Eliz. c. 1) much heavier fines and penalties were inflicted for this offence, and imprisonment was added where the person who refused to attend church was a schoolmaster. The provisions of this Act were confirmed by 29 Eliz. c. 6, which gave the queen power to seize all the goods and two-thirds of the lands of all offenders who failed to pay a fine of £20 a month. By 3 Jac. I. c. 4, s. 11, the king might refuse the payment of £20 a month and take two-thirds of the offender's land, at his option; and a penalty of £10 a month was imposed upon any person maintaining or harbouring in his house any servant, stranger, or traveller who refused to attend the church for a month together.

Charles I. adopted towards the nonconformists the policy of his predecessors. In carrying into execution his designs against Puritanism he found an able and zealous assistant in Archbishop Laud, under whose arbitrary administration the proceedings of the Star Chamber and High Commission Court were characterized by great cruelty. Many of the Puritans sought for safety and quiet in emigration, and the colony of Massachusetts Bay was founded by them in North America. But a proclamation by the king put a stop to this self-banishment, and thus even the miserable consolation of expatriation was denied. But a change was approaching, and in 1644 Laud was beheaded (five years before his royal master). The Parliament subsequently abolished episcopacy and everything in the church that was opposed to the model of the Geneva Church.

The Restoration in 1660 placed Charles II. on the throne of his ancestors, and led to the restitution of the old system of church government and worship, many Acts being passed to promote conformity. Of these the most important was the Act of Uniformity, passed 24th August, 1662, which led to the resignation of a large number of ministers (2000, according to most historians), the majority of whom helped to swell the ranks of the Presbyterians and Independents. Another statute, known as the Five-mile Act (17 Car. II. c. 2), banished the nonconformist clergy to that distance from every corporate town where they had formerly preached, and forbade them to officiate as schoolmasters except on condition of their taking the oath of passive obedience. The Corporation Act (13 Car. II. c. 1, s. 2), though directed against the Roman Catholics, pressed with equal severity against Protestant dissenters, and excluded from offices in municipal corporations those who refused to receive the eucharist according to the rubric of the Church of England. This was followed by the Test Act (25 Car. II. c. 2).

In the reign of William III. the Toleration Act (1 Will. III. c. 18) gave immunity to all Protestant dissenters, except those who denied the Trinity, from the penal laws to which they had been subjected. The benefits conferred by the Toleration Act were subsequently much abridged by the Occasional Communion Act, which excluded many nonconformists from civil office, and by the Schism Act, which restricted the work of education to certificated churchmen.

During the latter portion of the eighteenth century, however, a more enlightened spirit prevailed, and by degrees most of the laws which restrained nonconformists from the free exercise of their religion were repealed. Those which hindered them from occupying civil offices and sharing in the benefits of the universities were maintained for a longer

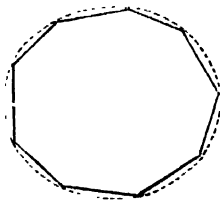
period; and though much has been done during the present generation to remove the disabilities under which nonconformists have laboured, the work can hardly yet be said to be fully accomplished.

At the present day, though a nonconformist minister is not regarded by the law as a person in holy orders, his status is recognized to a limited extent, and while he cannot be elected alderman or councillor, he is exempt from certain parochial offices and from serving in the militia or on a jury. By the Marriage Act of 1836 (6 & 7 Will. IV. c. 85) the ceremony of marriage may be performed in a nonconformist place of worship, but it must be after due notice to the superintendent registrar, and in his presence or that of a registrar, and the building must be one that is duly certified for marriages. By the Burial Laws Amendment Act of 1880 (43 & 44 Vict. c. 41) burial may take place in a churchyard without the rites of the Church of England; but in such case notice must be given in a specified form, which is unnecessary where the burial is conducted by a clergyman of the Church of England.

It would be a task of some difficulty to enumerate the various religious bodies which are classed under the general head of nonconformists; a description of all the principal denominations will be found under separate headings. See BAPTISTS; FRIENDS; CONGREGATIONALISM; METHODISM, &c.

NON-EFFECTIVE is the term applied to those officers and men of the army or navy who are not on active service. The estimates are divided into payments for effective and non-effective services; and the amount voted for the latter in the British army is nearly £3,000,000 per annum. The largest sums are for pensions, half-pay to reduced and retired officers, and rewards for distinguished services. The non-effective service of the navy costs more than £2,000,000 per annum. In volunteer regiments a non-effective is an honorary member, or one who has failed to go through the requisite number of drills.

NON'AGON, a nine-sided and nine-angled figure in geometry, as shown in annexed cut. A regular nonagon is one whose sides and angles are equal.



NONES (Lat. *nona*), the Regular Nonagon inscribed in a circle.

ninth day before the ides in the Roman month—reckoning, Roman fashion, both extremes in. We should now consider the nones to be eight days before the ides. See IDES.

NONES (Lat. *nonus*, ninth) was the church service anciently observed at the ninth hour or three o'clock in the afternoon—one of the CANONICAL HOURS. Nones gave us our English word noon, and when nones became shifted from three p.m. to twelve, noon became thereby synonymous with midday, and has ever thus remained.

NONJOIN'DER, PLEA OF. Where a person has been left out, either as plaintiff or defendant in an action, who should have been made a party, the defendant may plead such fact. This abates the action until the defect be remedied.

NONJURORS were clergymen of the Church of England who declined to swear an oath of allegiance to William and Mary—the term *nonjuror* signifying *non-swearer*. They believed that the Prince of Orange had unlawfully possessed himself of the throne abdicated by James II. They were allowed six months longer than laymen to make up their minds; but they conscientiously refused, and were deprived of their sees and benefices. The nonjurors comprised Sancroft, archbishop of Canterbury

from the year 1677 to 1689, eight bishops, and about 400 of the inferior clergy.

NON-RESIDENCE, in English law, is the offence committed by the incumbent of a benefice who unduly absents himself from it without special license from his bishop. It is punishable by monition and sequestration.

NON SUIT is the name given to a judgment whereby an issue is determined against the plaintiff. Formerly it was used to express the opinion of the court that, apart from its merits, the plaintiff's case was incomplete; but it did not prevent him from bringing another action for the same cause. A plaintiff might himself apply for the entering of a nonsuit, or the court might direct it to be entered against his will. Since the passing of the Judicature Act of 1875 (Ord. xli. r. 6) it has the same effect as a judgment on the merits of the case unless the court otherwise direct.

This phrase is not used in Scotch law, but "dismissal of the action" is in many respects its equivalent. When the form in which an action is laid is unsuitable to decide the subject-matter in controversy, or to give the appropriate remedy, the action will be dismissed, reserving to the pursuer to raise it in another form or before another tribunal. This may be done on a plea to that effect by the defender or *ex proprio motu* of the court, or even on the motion of the pursuer himself, on being satisfied that such a course is most conducive to his own interests. In general, however, the court will make leave to bring a new action conditional on the costs of the defender in the original action being paid. The recent legislation, by which important amendments may be made in the course of an action, has greatly diminished the frequency of dismissing and abandoning actions.

NORA'GHE. To a curious class of monuments which abound in Sardinia, and whose origin and uses at present are but imperfectly understood or guessed at, this name is popularly given. Their plan is generally circular or elliptical, their form that of a truncated cone. A door placed towards the south-east opens into a corridor, which communicates with two ranges of chambers before reaching the centre of the building. The Noraghe are divided by antiquarians into four kinds—the *simple*, which may be likened to isolated towers; the *collective*, composed of several of these combined; the *united*, a large inclosure, generally situated on the summit of a hill; and the *surrounded*, which are encircled with outworks like a fortress. As many as 3000 Noraghe are scattered over the island of Sardinia; and though their origin is disputed, little doubt, we think, need be entertained that they are *tumuli* or sepulchral monuments erected in honour of some famous chief.

NORD, a department in France, thus named from its being the most northern division of that country, bounded E. by Belgium, S. by the department of Aisne, W. by those of Somme and Pas-de-Calais, and N. by the North Sea. It is formed of the old province of French Flanders, of nearly the whole of Hainaut Français and Cambresis, and of small portions of Artois and Vermandois. Its length from Dunkirk to the south of Trélon is about 124 miles; its breadth is very variable, being 39 miles at the widest part, but not quite 4 miles near Armentières, where it is crossed by the Lys. The area is 2192.5 square miles, and the population in 1882 was 1,603,259.

Soil and Surface.—The department belongs almost entirely to the basin of the Scheldt or Escaut. It has a general inclination towards the north-east. The surface, except in the south of the department, is level. Some isolated hills spring up here and there, which seem to be higher than they really are in consequence of the general flatness of the country. Mont-Cassel, in the arrondissement of Hazebrouck, famous for the extensive view from its summit, is only 575 feet above the sea-level. The climate of the department is cold and humid. The soil

is in general good; but in such an extent of surface the variety of course is great, from the deep rich clay and marly soil of the arrondissement of Lille, to the barren sand-hills on the coast, and to the light gravelly soil of the southern districts. But everywhere the system of agriculture is good, and fine crops are gathered.

The department produces wheat, barley, oats, and other grain, tobacco—which is cultivated over 5000 acres—hemp, lint, flax, &c. A good deal of the barley grown is used for malting, beer being the common beverage; other grain and potatoes are also used in the gin and spirit distilleries. Apples, pears, nuts, and other common fruits are cultivated; flowers are objects of special attention, and hops are also grown.

The horses of the department are large, strong, and of good breed. A great number of horned cattle are fed on the natural pastures and on the abundant green crops that are raised. The number of sheep reared to supply the markets with mutton and for the growth of wool is very considerable. Good butter and cheese are made. Coal is the common fuel.

Hydrography.—The principal rivers of the department are—the AA, which runs along the western boundary, and enters the North Sea at Gravelines, where it forms a small harbour; the Ysser, which receives the Peene below Wormhout, and runs north-east into Belgium; the Lys, a feeder of the Scheldt or Escaut, which is itself fed by the Lawe and the Deule; the Scarpe, which, rising in Pas-de-Calais, runs east past Douai, and joins the Scheldt at Mortagne, on the Belgian frontier; the Scheldt (Fr. *Escaut*), which, rising in the north of the department of Aisne, flows north to Cambria, whence it runs north-east past Valenciennes and Condé, 7 miles north of which it enters Belgium, having received the Seneffe at Bouchain, the Selles and the Escaillon between Bouchain and Valenciennes, and the Haine at Condé; and the Sambre, which crosses the south of the department, passing Landreies and Maubeuge, below which it enters Belgium on its way to join the Meuse. Most of these streams have been rendered navigable; they, with the canals that traverse the department in all directions, afford complete internal navigation. Of the canals, particular mention must be made of St. Quentin, which, running from Cambria to St. Quentin, unites the Scheldt to the Somme, and completes the internal navigation between the North Sea, the Atlantic, and the Mediterranean.

Mines.—The mineral wealth of the department consists chiefly of its coal and iron mines. Marble, paving stones, brick-earth, potter's clay, peat, bitumen, and fossil ashes, which are used as manure, are found. There are mineral waters and baths at St. Amand.

Manufactures.—This is the most industrious department in France: the manufactures, which are of the most varied description, include all kinds of woollen, cotton, and linen fabrics, likewise thread of all sorts, ticking, duck, velvet, printed cottons and handkerchiefs, woollen, flaxen, cotton, and hempen yarn, lace, tulle, cambric and lawn, soap, refined sugar and salt, beer, oil, nails, glass, paper, tiles, bricks, earthenware, ropes, leather, toys, small wares, cannon, small arms, saltpetre, &c. There are also many iron forges, some marble works, and manufactories of chemical products. These numerous products form the items of a large home and foreign commerce. The imports are chiefly raw cotton, wool, flax, colonial produce, wine, brandy, and timber. The department is divided into the seven arrondissements of Lille, Douai, Dunkirk, Hazebrouck, Avesnes, Valenciennes, and Cambrai. The capital is LILLE.

NOR'DENFELT GUNS. See Gun.

NORFOLK, a maritime county of England on the eastern coast. It is bounded S.E. and S. by Suffolk, S.W. and W. by Cambridgeshire and Lincolnshire, N. and N.E. by the North Sea or German Ocean. Its greatest length east

to west is 67 miles; its greatest breadth north to south is 40 miles. The area is 2119 square miles, or 1,356,173 acres. The population in 1881 was 444,825.

Coast-line and Surface.—The Norfolk coast-line, which is 100 miles in length, commences at the estuary of the Yare, and extends in a regular convex curve to the Wash. It is liable to continual encroachments from the sea, which, especially about Cromer, has gained greatly on it. The Wash is an estuary, having extensive sandbanks dry at low water, with channels of deeper water between them; but a considerable portion of its area has been reclaimed and cultivated. The Ouse and the Nen both flow into it. The deeper water off the coast is known as Lynn Deep. There are a number of small creeks and harbours:—Yarmouth, Clay and Blakeney, Wells, Burnham, Brancaster, Thornham, Headham, Snettisham, and Lynn.

Norfolk is on the whole a flat county. The rivers flow through valleys of varying breadth, skirted by low rising grounds or uplands. The highest ground in the county is probably on the north-west side, where the chalk downs appear. This high ground subsides gradually toward the east, where the chalk sinks under the beds of alluvium which overspread a large portion of the shire. The western part is included in the great Fen district.

Chalk is dug for lime in many places; excellent sand for glass making is procured between Snettisham and Castle Rising; some potter's earth is found and excellent brick clay; marl is dug in the valley of the Bure, and the Fen districts of the west furnish peat for fuel and manure.

The principal streams flow from the north-west part of the county, where the chalk occupies the surface. The Wensum rises in the neighbourhood of Fakenham, and flows south-east in a winding channel 45 miles to Norwich, 2 miles below which it joins the Yare. The Yare rises at Shipham, between Watton and East Dereham, and runs eastward to its junction with the Wensum 25 miles. The united stream flows 20 miles, till it expands into a large sheet of water called Breydon Water, 4 miles long and in some parts a mile broad, at the south-western extremity of which it receives the Waveney, and at the north-eastern the Bure. It then bends and flows 3 miles southward into the German Ocean. The Waveney rises at Lopham, between Thetford and Diss, and winds past Diss, Harleston, Bungay, and Beccles, to its junction with the Yare, nearly 50 miles. The Bure rises in the northern part of the county, and flows past Aylsham 50 miles to its junction with the Yare. These rivers form many shallow lakes or pools called *broads* or *meres*.

The streams of the western side of the county belong chiefly to the system of the Ouse, which touches the border of the county near Littleport, a few miles below Ely, and flows northward 22 miles into the Wash below Lynn. The Norfolk rivers of this system are the Little Ouse, the Wissey, the Nar, and the Welney. Besides these rivers a number of smaller streams fall into the sea to the north.

Few parts of England exhibit marks of more remarkable changes than this county. The valleys of the Waveney, Yare, and Bure were originally longitudinal basins of chalk; and subsequently to the deposition of those beds of gravel and sand which cover a large portion of this side of the island, were probably arms of the sea. The low flats north of Yarmouth, in which are so many "broads," were also parts of an estuary which probably remained till the time of Edward the Confessor, but has since been left dry. There are local traditions of the sea having once reached Norwich on the Wensum and Bungay Castle on the Waveney. Indeed it is supposed that the eastern part of Norfolk was formerly a group of low islands.

The Wensum and Yare are navigable to Norwich for sea-borne vessels; and these, as well as the Waveney, have been greatly improved for navigation by artificial means. There are a few short canals in connection with the rivers.

Climate, Soil, and Agriculture.—The climate of Norfolk is somewhat colder than that of the southern and western counties of England. The coast is exposed to the north-east winds; but except in a small portion on its western boundary, and a strip along the southern part, which are marshy, the air is dry and healthy. It is, on the whole, as favourable to the tillage of the land and the growth of corn as any part of England.

The soil may be divided into three classes; light sands of various qualities, chiefly in the north-western districts; low alluvial clays and loams, on the borders of Lincolnshire and Cambridgeshire; and loams of various qualities, chiefly light, incumbent on a marly clay, in the east and centre. There is a strip of peat and marsh along the southern boundary.

The district in which the true Norfolk system of cultivation was first adopted, and where turnips and clover were introduced in the regular rotations, was the north-west, where the better kinds of sand prevail. From this district it has gradually spread, and there are now few soils in the county which are considered too heavy to bear turnips, especially after having been well underdrained.

The crop raised in the greatest perfection in Norfolk is barley. It may be considered as the most important portion of its agricultural produce. There are few other counties where such an extent of poor unproductive land has been brought into cultivation. This has been effected chiefly by laying considerable portions of the marly clay, found a little below the surface, on the poorer soil which was at the surface, and by an excellent system of draining the land where the subsoil is impervious to water.

According to the official agricultural statistics the extent of land under cultivation in 1885 was 1,100,000 acres. Wheat was grown on 180,000 acres, barley on 195,000 acres, and turnips and swedes on 135,000 acres, clover and other artificial grasses on 160,000 acres, and 270,000 acres were permanent pasture.

The number of cattle in the county in the same year was 120,000, and of sheep 600,000. Large numbers of lean cattle are brought here to fatten, more especially to the salt marshes and the extreme east and west of the county.

Norfolk is in the diocese of Norwich and the Norfolk circuit, the assizes being held at Norwich. Under the Redistribution of Seats' Act of 1885 the county returns ten members to the House of Commons—eight for single-member divisions of the county, and two for the city of Norwich.

History and Antiquities.—Norfolk formed part of the dominions of the Iceni or Sineni, a people who allied themselves with the Romans in the time of Claudius. Under the Romans Norfolk was included in the province of Flavia Caesariensis. There were many British and Roman towns or posts in this county.

In the general conquest of England by the Saxons and their kindred tribes, Norfolk and Suffolk and some parts of the adjacent counties were formed into the kingdom of East Anglia. In the great invasion of England by the Danes or Northmen, under the sons and kinsmen of Lodbrog, East Anglia was the first part attacked. The Northmen in 866 landed and formed a camp, in which they passed the winter, demanding and receiving from the East Anglians a supply of horses.

After the Conquest the earldom of the East Angles (Norfolk and Suffolk) was bestowed on the Breton Ralf de Guader, who, having rebelled, together with the Earl of Hereford, was overpowered by the king's brother Odo, and banished, when the earldom was bestowed by William the Conqueror on Roger Bigod. On the death of William, Roger supported the claim of his eldest son Robert to the throne, but soon was obliged to submit to William Rufus.

Of the edifices of the middle ages, monastic, ecclesiastical, or castellated, Norfolk has several remains, among

which are—Langley Abbey, the abbey of St. Bennet of Hulme, Broomhall Priory, Beeston Priory, Binham Priory, Castle Acre, Castle Rising, Caistor Castle, and several ancient manor-houses.

NORFOLK, a seaport of Virginia, and the most important naval station of the United States, situated 106 miles south-east from Richmond, on the north-east bank of Elizabeth River, 8 miles from its entrance into Hampton Roads. The river, which is nearly a mile wide, separates Norfolk from Portsmouth, on the opposite side. The harbour is excellent, sheltered from all winds, and has depth of water for the largest vessels. Its foreign commerce is the most extensive of any place in the state, and, next to Richmond and Petersburg, was the most populous town at the last census. The site of the city is almost a dead level; the plan is somewhat irregular, the streets are wide, and the houses generally well built of brick or stone. The most conspicuous public buildings are the city-hall, the Norfolk military academy, the mechanics' hall, custom-house, Ashland Hall, and a Baptist church, with a steeple 200 feet high. There are numerous churches and seminaries, an hospital, an orphan asylum, and several banks. The trade of Norfolk is facilitated by the Dismal Swamp Canal, which opens a communication between Chesapeake Bay and Albemarle Sound, and by the Seaboard and Roanoke Railroad, which connects it with the towns of North and South Carolina. The canal, constructed with great labour through the Dismal Swamp, is navigable by schooners. There is also a line of railway to Petersburg and the interior of Virginia. Norfolk has good railway connection, and an extensive trade in sugar, corn, lumber, cotton, market produce, and oysters. It communicates with New York and Philadelphia by regular lines of ocean steamers. The entrance to the harbour is defended by Forts Calhoun and Monroe, the latter the largest in America. Norfolk was founded in 1705, and burnt by order of Lord Dunmore, the British governor, in 1776. The population in 1880 was 21,966.

NORFOLK, EARLS AND DUKES OF, Earls Marshal of England. The present ducal title is (with the one exception of Somerset, created 1547) by nearly two centuries the oldest existing dukedom of England, and in consequence is said to head the English peerage. The earldom of Norfolk dates from the Conqueror, Ralf de Guader being the first earl. The greatness of the house of Norfolk began in 1135, when Henry I. created Hugh Bigod Earl of Norfolk and the East Angles. In the troublous times after Henry's death, the earl seized Norwich and held it on his own account. It was not without resort to force that the fierce Bigod was brought under by Henry II. in 1167, and he did not regain his honours till 1167. He died in 1177.

The first of the Earls Bigod of Norfolk to become Earl Marshal (an office created by Stephen in 1135) was Roger Bigod, in 1226. He was his nephew, namesake, and successor (succeeded 1270) who bearded the great Edward when he infringed the English laws by taking the barons out of England against their consent. ("Bigod, I will Earl, you shall go, or hang." "By God, Sir King, I will neither go nor hang.") This Earl Marshal, with Humphrey de Bohun, wrung from Edward the confirmation of the charter. He was one of England's best patriots. Edward compelled him to surrender his office and his lands in 1302, but could not tame his spirit. In 1307 the title died with him. The dignity of Earl Marshal had become familiarly connected with the title of Norfolk, so that in creating his own brother Prince Thomas Earl of Norfolk, Edward II. also made him Earl Marshal (1313). Again the title died out.

A new start was made by Thomas Mowbray, created Earl Marshal by Richard II. in 1386, and Duke of Norfolk in 1396. The dukedom of Norfolk may therefore be held to begin at this early date, in which case the

first duke of the family of Howard would be the seventh duke, and the title would (but for Somerset) head by three centuries the rest of the peerage. This Duke of Norfolk is he who figures in history (and in Shakspeare) so prominently as the cause of Richard's fall, which resulted from the king's most unjust interference in the quarrel between the duke and Henry of Hereford (Henry IV.) in 1398. Mowbray was banished for life, and died in exile in 1399 (some authorities say in 1413).

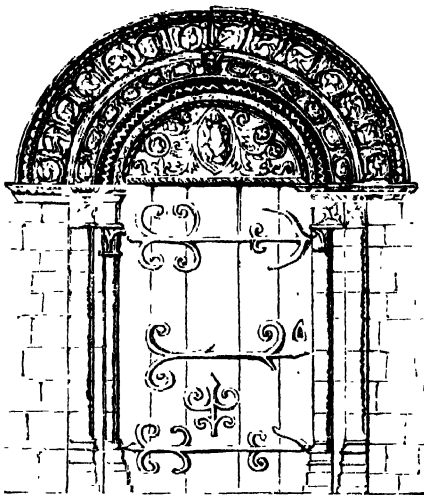
The present family is derived from Sir John Howard, knight, son of Margaret, the heiress of the Mowbrays, who fought under Talbot in France, and later on served in many honourable offices under Henry VI. and Edward IV., such as ambassador to Louis XI., 1468; governor of Calais, 1471; captain-general against the Scots, 1479, &c. Eventually he was created Duke of Norfolk, Lord Admiral, and Earl Marshal by his patron Richard III. on his accession. He fell at Bosworth in 1485, and the title was attained. His son, Thomas Howard, was restored to his title of Earl of Surrey in 1488, and became as useful a servant of the state as his father. He became Earl Marshal in 1510. The victory of Flodden was gained by him in 1513, and as a reward his father's title as Duke of Norfolk was conferred upon him in 1514. He died in 1524. His son, the third (or tenth) duke served as lord admiral, as lord lieutenant of Ireland, &c., in a similarly distinguished way; he, too, was an Earl Marshal (1534). He was Henry VIII.'s Norfolk, known to us as the relative of one of Henry's wives (Anne Boleyn), and the uncle of another (Catherine Howard). The Pilgrimage of Grace was suppressed by him; he served the king well against the Scots (Solway, 1542); he bearded both Wolsey and Cromwell, for the king's pleasure, and yet he was only saved from the axe by the tyrant's death in 1547. Norfolk lived to do further service to the crown. He it was who suppressed the outbreak of Sir Thomas Wyatt against Mary (1554). He died in the same year. His son, the fourth (or eleventh) duke, is famous as having plotted to marry Mary, queen of Scots, and establish a Catholic reaction; for, like his father, he had steadily adhered to the old faith, and the family, even down to the present time, have followed the example. For his treason he was beheaded on Tower Hill in 1572. His descendant, Thomas Howard, was restored as Earl of Arundel and Surrey in 1603. He was one of the very few converts of his family to Protestantism (1614). He was made Earl Marshal for life in 1621. He took the royalist side, and was in consequence created Earl of Norfolk in 1641. He had hoped for the dukedom, and quitted England in dudgeon. He died in exile at Padua in 1646. It is to him we owe the famous ARUNDEL MARBLES of Oxford. In 1672 Charles II. made the dignity of Earl Marshal hereditary in the Howard family, to which the dukedom was subsequently restored.

NORFOLK ISLAND is situated in the Pacific Ocean, between 29° and 29° 10' S. lat., and 168° and 168° 5' E. lon., about 1200 miles E.N.E. from Sydney. It is about 6 miles long from N.W. to S.E., and nearly 3 in breadth. As it was found to be well supplied with water, and the soil very fertile, a British settlement was formed in 1789, from Sydney in Australia; but from various causes it was abandoned. Norfolk Island was afterwards made a penal colony for convicts of the worst class from Australia; but it has since been cleared of felons, and colonized by the Pitcairn Islanders, under the government of New South Wales. The climate is healthy. The island covers 8607 acres, and in its centre is Mount Pitt, 1050 feet above the sea. The characteristic tree, *Aracaria excelsa*, one of the coniferous family, rising sometimes to a height of 270 feet, with a diameter of 12 feet, is often called the Norfolk Island Pine, but it is not peculiar to the island.

NORFOLK ISLAND PINE. See ARACARIA.

NORFOLK SCHOOLS. See SCHOOLS.

NORMAN ARCHITECTURE, the round-arched style which was developed in England from the Romanesque architecture, and was the precursor and in many ways the source of the Gothic, was introduced into this country a few years before the Conquest, in the reign of Edward the Confessor; and was the prevalent style during the reigns of William the Conqueror, William Rufus, Henry I., Stephen, Henry II., and Richard I. It was gradually



Norman Doorway (Barfreton Church, Kent).

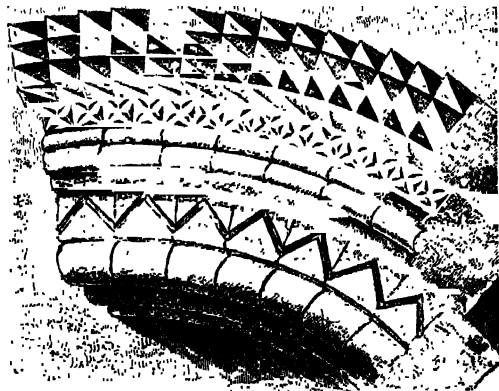
superseded by the Early English Pointed; and many interesting examples still exist—particularly in Canterbury Cathedral and the Temple Church, London—in which the transition of the one style into the other can be clearly traced and advantageously studied. Many very competent authorities prefer to the usually accepted origin of the pointed arch [see **GOthic ARCHITECTURE**], a derivation which would regard it as the outcome of the intersections of a barrel-vaulted structure with nave and transepts, where the outline of the arches of intersection necessarily



Norman Pillars and Capitals.

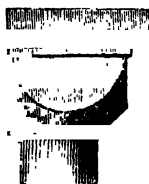
becomes a pointed one. Norman architecture extended over a period of about a century and a half, or from 1060 to the close of the twelfth century. In its early stage it was massive and comparatively plain, the ornaments used being such as could be executed with the axe or refined imitations of such forms; at a later period it

was somewhat lighter in character and much more highly decorated, and the chisel was freely used in the sculptured ornaments. The finest Norman buildings in England were constructed between 1120 and 1185. Fifteen of the twenty-two English cathedrals contain specimens of Norman architecture, among which the finest example is the nave of Durham. Also we may mention the western towers and nave at Ely, the older Lady chapel and chapter-house at Bristol, the choir at Canterbury, the nave and choir at Norwich, the transept, tower, and choir at Hereford, the nave and choir at Wells, the chapter-house at Chester, the presbytery at Chichester, and the transept at Peterborough. Norman architecture embodied several peculiari-



Norman Dog-tooth Mouldings, Lenchars Church.

ties of the Saxon, which preceded it, but is far superior to its predecessor both in the workmanship and in the dimensions and decorations of its buildings. Its prominent characteristics are massiveness and the general use of the round arch, though the pointed arch also occasionally occurs; columns of large diameter in proportion to their height, circular, hexagonal, or octagonal in shape, with their shafts plain, fluted, lozenge, or reticulated; capitals sometimes plain, but more commonly decorated, with a peculiar abacus of a square section, with its lower part chamfered off either by a plain line or a slight curve; ceilings usually of timber, except in crypts, where they are vaulted with stone; and walls of remarkable thickness, with but few, plain, and slightly projecting buttresses. Its



Cushion Capitals, Norman.

most usual ornaments are the chevron or zigzag, beautifully shown in the annexed example from Kelso, the embattled frette, the triangular frette, the nail-head, the billet, the cable, the hatchet, the lozenge, the nebule, beak head, dog-tooth, and occasionally different sorts of foliage, such as the vine, the bay, the ivy, &c. The Norman churches have generally transepts, with a massive tower at the intersections, but no spire, and the east ends are semicircular. Norwich and Peterborough cathedrals are the finest English

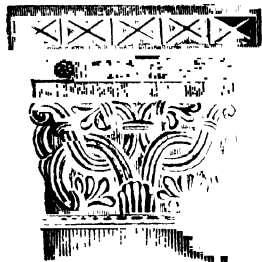
examples of these semicircular chancels; but in both the old windows have been altered by the insertion of tracery, or new windows have been inserted. A favourite Norman ornament of external plain surfaces is the Romanesque device of blind arcades. A finely characteristic specimen from Kelso Abbey is annexed. Many of the Norman doorways are very noble, and almost every county in England



Norman Arcade from Kelso Abbey.

contains some examples of them. The finest belong to the time of King Stephen or Henry II., and they appear frequently to have been inserted in earlier Norman work, as at Lincoln and Rochester. Ely, Durham, and Worcester have also fine Norman portals; and in delicacy of execution and intricacy of design, the college gateway at Bristol can scarcely be surpassed.

The first period of Norman architecture extends from 1060 to 1087, or to the end of the reign of William the



Norman Capitals, Enriched.

Conqueror. As previously stated, Edward the Confessor, who had been brought up in Normandy, introduced its architecture into England. He founded the Abbey of Westminster, the church of which was consecrated for divine service in 1065, only a few days before his death. The walls and vaulted substructure of the dormitory of the abbey still remain, the work being rude and clumsy Nor-

man, with wide-jointed masonry, and the capitals left plain, to be painted or carved afterwards. Several cathedrals, abbeys, and castles were built in various parts of England during the reign of William the Conqueror; and the churches of St. Stephen and the Holy Trinity at Caen in Normandy, founded by him and his queen Matilda, afford good foreign examples of the ecclesiastical architecture of

his reign. He was a great castle-builder; and the towers of London, York, Lincoln, Rochester, and Canterbury were all constructed by him.

The second period of Norman architecture comprises the reigns of William Rufus and Henry I. The former built the Great Hall of the Palace of Westminster, which was afterwards altered by Richard II. The original Norman work may now be seen, since the removal of the law courts which obscured it. Specimens of the time of Rufus are to be seen in the choir, side aisles, and middle transept at Durham; in the walls of the lower part of the western façade of Lincoln; the towers and transepts of St. Alban's; the oldest remaining parts of Winchester; and the east end and cross aisle of Worcester. Under the reign of Henry I., Roger Poer, bishop of Salisbury, distinguished as a prelate, warrior, statesman, and architect, gave a strong impulse to Norman architecture, and greatly improved the excellence of its workmanship and the character of its ornament. The architecture of this

reign may be studied in the naves of Gloucester, Norwich, Ely, Durham, and Southwell.

The third period, or that of the rich or decorated Norman, belongs to the reigns of Stephen and Henry II. In the former reign the comparative plainness that still characterized the buildings of the time of Henry I. began to disappear, and the chisel was freely used in carving capitals and for other decorative purposes. Lincoln Cathedral was restored in this reign, and to it also belongs

Kirkstall Abbey, in the West Riding of Yorkshire, where the style is Norman with pointed arches. The finest foreign example of this period was the Abbey Church of St. Denis, near Paris, rebuilt by the celebrated Abbé Suger. The richest specimens of the Norman style in England belong to the reign of Henry II. Several of our finest Norman cathedrals were then constructed completely or in great part—such as Peterborough; St. Frideswide's (Christ Church), Oxford; Ely; Canterbury; the Temple Church, London; and others. The Galilee, or great western porch of Durham Cathedral, built by Bishop Bisset, is a noble example of this last and richest period of the Norman style. It is in fact transitional, but the arches are round, not

pointed. One of the best foreign examples of this period is the Church of Notre Dame, in Paris, which presents a good specimen of the transition from Norman to Early Pointed, in its massive round pillars and pointed arches. The best place in England for studying this process of transition is unquestionably the choir of Canterbury Cathedral. The minute account of the work left to us by Gervase, an eye-

witness of it, enabled Professor Willis, on carefully examining the building, to find the joints in the masonry where the cessation of the work for the winter took place, and so to date every arch of the structure, and almost every stone. The central part only was rebuilt, the outer walls being preserved up to a certain height and raised. The work began at the west end next the transept, in 1175, and these arches are semicircular, and their mouldings and capitals are still late Norman; but before the completion of the work in 1184, when the corona or eastern chapel was built, the arches have become pointed, and the details almost pure Early English. From this period Norman architecture fell gradually into disuse, and was superseded by the Early Pointed. For further details and illustrations of Norman architecture, see the article *ENGLISH CATHEDRAL ARCHITECTURE* and accompanying Plates.

NOR'MANDY, the ancient *Neustria*, one of the provinces into which France was divided before the first Revolution, was bounded N. and W. by the English Channel, E. by Picardy and Ile-de-France, and S. by Maine and Bretagne. The district is one of the most attractive portions of France. Parts of the upper country are certainly a flat, monotonous table-land; but in its joyous sunny slopes and winding dales, in its hedgerows, orchards, thatched cottages with gardens, in the general character of the landscape of La Basse Normandie, especially in its verdure, frequent village spires, and white chalk cliffs, it has a resemblance to the features of an English landscape which no other part of the Continent affords. On the decay of the Roman power it was reduced to subjection by the Franks, from whom it was wrested in 876 by the Northmen or Normans, under Rolf, Rou, or Rollo, and governed by its own dukes till the time of William the Conqueror, after whose conquest of England it was subject to the English kings till 1204, when Philippe Auguste united it to the dominions of France. The English again seized it, and held it from 1419 to 1425, in which year Charles VII. drove them from the territory of France. The dukes of Normandy were great vassals of the French crown. The history of the country is closely interwoven with the histories of France and England. The province before the Revolution had a Parliament of its own, which sat at Rouen. In religious matters it was subject to the Archbishop of Rouen.

Normandy now forms the departments of *SEINE-INFÉRIEURE*, *EURE*, *CALVADOS*, *MANCHE*, and of *ORNE*, with the exception of the arrondissement of Mortagne. The Norman Isles comprise the Channel Islands—*JERSEY*, *GUERNSEY*, &c.—which are the sole portions of Normandy remaining to England, in whose possession they have remained since the Conquest.

NORMANS. See *FRANCE* and *NORTHMEN*.

NORNS, in the Norse mythology, the three Fates, equivalent to the Greek *Moirai*, or Destinies. Their names were *Urd*, *Verlandi*, and *Skuld*, that is, Present, Past, and Future. Even the gods obeyed their irrevocable decrees; and though they were gifted with great beauty, yet, as besetted the arbiters of all things, their aspect was gravely sorrowful. Their function it was to sprinkle the ash-tree *Ygdrasil* daily with water from their sacred fountain that it should not wither, and so the whole world perish. Their decrees were not of their own originating, although they appear to have carried power over the details of their execution: rather were they the interpreters of a mysterious *Orlog*, an impersonal unbegotten entity, who represents the eternal law of the universe, the irrevocable, self-moving destiny of all things. If, as often happens in Norse myths, the Norns differ in the spirit of their prophecies, it is *Urd* who always utters the kindly predictions, *Skuld* who decrees the terrible.

NORR'KÖPING, a port in Sweden, situated on the banks of the river *Motala*, which falls into an inlet of the Baltic, a short distance below the town. It is built on

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both sides of the river. The streets are wide and generally straight, though the place stands on undulating ground; the houses, partly of wood and partly of stone, are only two storeys high, but have a neat appearance. The town is 85 miles south-west of Stockholm, and has 28,000 inhabitants, who are chiefly employed in manufactories of brass and hardwares; linen, cotton, and woollen fabrics; gloves, starch, snuff, paper, and leather; sugar refineries, oil-mills, shipbuilding docks, and a salmon fishery. Iron is an important article of export, and most of the grain grown in the plain of *Lindhöping* is shipped at this harbour.

NORSE, or more correctly **NORSK**. See *NORWAY*, section *Language*.

NORSE MYTHOLOGY. Under this heading is comprised, in the present work, the faith of our own English (not British) ancestors, and indeed of all Scandinavian and Teutonic nations. It is generally believed that in origin this remarkable series of religious myths is Scandinavian, and only by development Teutonic. The whole comes down to us preserved in ancient legends, collected in the Norse *Eddas* of Iceland. Iceland was to ancient Scandinavia in general what in Cæsar's day the islands off the west of Britain were to ancient Gaul in general, a distant place, separated too by sea, and kept from contact with the progress of the world—fitted therefore to be the home of ancient religions, which could there be preserved in their purity. In Iceland, then, the Christian priest, *Sæmund Sigfusson* (1056-1133), deciphered the Runic inscriptions, and collected the traditional myths of unknown antiquity, adding as well those contained in the ancient Norse Scriptures, whence the famous "old" (or "poetical") *Edda* arose. A century later this was put into prose, with certain differences, as the "new" (or "prose") *Edda*, by *Snorro Sturleson* (1178-1241). As with the classical mythology of Greece and Rome [see *MYTHOLOGY*], so here with the Norse mythology, it is purposed to give as connected a sketch, in barest outline, as may be put together from detached, confused, and often contradictory sources, in order to present an intelligible idea of the whole conception. All the main features will be found described fully under their separate headings.

The Norse chaos was a huge abyss called *Ginnungagap*, the yawning pit of darkness. All-father, the uncreated, unnamed, invisible, formless spirit of the universe, alone existed then as ever behind all the assumed phenomena of the religious imaginings of our forefathers. On the north gradually arose *Niflheim*, home of mist and ice; on the south arose *Muspelheim*, home of fire and smoke. Then burst forth from the ice the well-spring *Hvergelmir*, and from this flowed twelve icy rivers, poisonous, creators of ice, snow, wind, and rain. The warmth of *Muspelheim* melted them, and they poured torrents of water into the great gulf. Under the warmth and moisture the Giant *Ymir* was created, the impersonation of shapeless nature, the clay giant, father of the *Hrimthurser* or frost giants. With him a monstrous cow, impersonation of animal nature, arose, and her milk fed the giants. She lived by licking the salt rocks, and licked them to such good purpose that she licked out the shape of *Buri* (the begetter), who sprang into life by the will of All-father. Descended from *Buri*, and a daughter of the *Hrimthurser*, were the gods *Wotan*, *Wili*, and *We*. Thus we arrive at the first trinity of the *Eddas*.

The three gods or *Ases* attacked and slew *Ymir*, whose brutal rage was unbearable. With his huge body they filled up *Ginnungagap*, but his blood made a deluge. The *Ases* (pillars, i.e. upholders of the world) did not perish, but all else did, save only one of the *Hrimthurser*, *Bergelmir*, with his wife. These two were saved by *Bergelmir* (like Noah) having made a boat. From *Ymir's* body came the earth, from his blood the sea, from his skull the sky, and the clouds from his scattered brains. Numberless

little creatures crawled in and out the dead giant's bones (hills) maggot-like; these were afterwards turned to use, as dwarfs and trolls, who live underground and have care of minerals and metals.

Now grew up the race of Ases, of most of whom the father was Wotan; or, as the Germans call him, Odin. Wotan's first partner was Jörd, the dark earth-goddess, a daughter of one of the giantesses. She bore him Thor, the chief of the gods, saving only father Wotan himself; Thor, whose mighty stature and strength, and whose terrific battle-hammer, Mjölnir, the swing of which is the lightning flash and the blow of which causes heaven and earth to shake with the roll of the thunder, pervade the whole mythology. Thor, prince of the Ases, is far more interesting than Wotan. After Thor's birth, Wotan left gentle Mother Earth and took as partner her lovely sister Frigg or Freya, goddess of beauty, whom he raised to be his equal in wisdom and power, and who sat beside him on Hlidskialf, his throne, whence all the world might be surveyed. The world was now divided by Wotan into a trinity of regions: Asgard, where he and the Ases dwelt; Midgard (middle *yard*, i.e. earth), which he purposed to fill with a race of mortals; and Utgard (outer earth), where lived the giants or Jotuns, also called therefore Jotunheim. Jotuns means gluttons; their other name, Thurses, means drinkers. Over all these regions could Wotan and Frigg see from Hlidskialf. Frigg is practically identical with Holda, the kind protectress, and Berchta, the bright—they are but other impersonations of her. The Teutons never distinguished between Frigg and Freya, but the Norse poets cast away the latter name so far as it applied to the queen of heaven. The Norse Freya is the sister of Freyer, and her father is Njörder—these three gods being only Ases by adoption. Wanes by origin. Who the "wise Wanes" were is left quite undetermined. The Ases fought with them long and bitterly, and the contest ceased with a mutual agreement to live in concord, the Wanes giving Njörder and his children as hostages. These three became so endeared to the Ases that they were received into the company of gods and treated as if they were truly Ases by origin. It is clear that the Wanes are gods of older races which the Scandinavians overcame, and whose Olympus was by force overthrown. These three deities, perhaps, answered to some want of the conquerors, and their worship was allowed therefore to remain, while that of their fellows perished.

By Frigg Wotan had Baldur, god of brightness or summer, and Hödur, the blind god of darkness or winter; Kinda bore him Wali, the avenger of Baldur. Heimdal, the guardian of heaven, was also a son of Wotan by nine mothers, wave-maidens. Probably the latter is a nature myth, representing the rain which rises as vapour from the sea to heaven, thence to fall and fructify the earth. Heimdal guarded the bridge Bifröst (rainbow) by which alone the Jotuns could cross into Asgard. Hermodur, the Norse Hercules, is also a son of Wotan. Beyond these other chief gods were Bragi, the Norse Apollo, regarding whose birth we are left absolutely without information, and his consort Iduna, the goddess of immortal youth, who rose from the grass before Bragi, when, at his first appearance, he sprang on shore from the dwarf's ship which had brought him, none know whence, across the ocean. Poetry and everlasting Spring are inseparable. Uller, the god of winter, the protector of plants by his thick-covering snow, the great archer, is also one of the chief gods whose origin is not accounted for. Nor is it clear whence comes Tyr, god of war, whose other names are Tius and Zio, evidently the Teutonic equivalents for the Sanskrit *Dyaus* and the Greek *Zeus* (Lat. *Jupiter*). The later poets endeavoured to make a circle of twelve chief deities, as in the classical Olympus; or rather they selected twelve gods, and the like number of goddesses. The twelve gods of the Norse

Olympus are Wotan, Thor, Baldur and his son Forseti, Njörder and his son Freyer, Tyr, Bragi, Heimdal, Uller, Widar, and Wali. Wali was the avenger of Baldur, Widar of Wotan. The hostages given by the Ases to the Wanes were Hödur and the wise Jotun Mimir (in exchange for Njörder, Freyer, and Freya). Hödur, the bright one, was a brother of Wotan; for besides the trinity before named of Wotan, Will, and We, we find also a trinity made up of Odin (Wotan), Hödur, and Lodur, presumably three brothers, or at all events three gods of equal powers. To these three, with an alder and an ash for their materials to work upon, is attributed the creation of the first pair, the Norse Adam and Eve, progenitors of mankind—Odin making their souls, Hödur their senses, and Lodur their blood. Some writers have considered that as Odin is the same as Wotan, so also Hödur and Lodur may be but Will and We over again. If this could be substantiated it would certainly clear the misty paths of the curiously intertwined forest of these myths. Others read Lodur as Loki, and this brings us finally to this most extraordinary conception of godhead.

Loki was the god of fire, but fire in its mischievous aspect. Changeable and tricky as flame, beautiful as flame and yet as ugly too, he is at one moment found among the Ases, at another among their enemies; now he accompanies Thor, disguised both of them as women, on a glorious expedition, and now he brings about the death of Baldur the beautiful. [See *LOKI*; *BALDUR*.] He deliberately chose evil, set up house in Jotunheim, married Anguish, the most terrible of the giantesses (Angurboda), and had by her the monsters Fenris, a wolf, Jörmungander, a snake, and Hel, the goddess of death and the grave. Horrified at these monsters Wotan had them brought before him, and flung them out into the ocean. Hel fell for nine days down into darkness, and here was set to rule the kingdom of the dead; the Snake coiled herself at the bottom of the sea round Midgard, the earth; and Fenris was chained by Tyr to a rock, but not before he had bitten the hand from one of the god's arms. Here the monsters all remained till the time came to destroy the world, and waiting with them, but far away in Muspelheim, were the gods of smoke and flame, led by dark Surtur with his flaming sword. Thus the bright Ases keep down the monsters and the dangers of the world.

The three Norns or fates fill the same office in the Norse as the Moirai in the classical mythology. The Walkyries or Walkyrs are the armed warrior-maidens of Wotan, who by his behest rule the fate of the combatants in battle. They ride to and fro in the fight on their white-cloud horses, and carry away the spirits of the fallen heroes, after giving them the death kiss, to their home in the brilliant palace, Valhalla.

The golden age came to an end by the ever-growing sin of the world of mortals, and even by the sin of the gods. This is certainly the most astonishing conception of the religion of our ancestors, and may readily be made to yield deep meanings. The catastrophe of the "twilight of the gods" was brought about by their growing fears of the powers of evil, the Jotuns, which led them to promise vast rewards—the sun, the moon, and even Freya herself, the goddess of beauty—to any one who would build them in one winter a wall high enough to keep out the giants for ever. The work was finished all but the gate by one of the Hrinthuruses (frost giants), who, disguising his real nature, undertook it, building it of the hardest ice; and the frightened Ases saw themselves on the point of gaining security at the cost of all their light and love. Their rash oath had been sworn on the advice of Loki; him, therefore, the Ases now seized and threatened with the worst of punishments unless he found means to stay the evil. This he did by enticing away the builder's horse, so that the materials for the gate could not be brought in

time. The enraged giant declared his name and nature and cursed the Ases for their treachery; which, however, did not prevent Thor from braining him with the hammer Mjölnir. Thus fatally did the gods sin. Their punishment began in the death of their beloved Baldur at the hands of the blind Hödur (summer slain by winter), and this, too, was due to the treachery of Loki [see BALDUR]. It availed not that they punished Loki in the most direful fashion they could think of; the end came on. The sin of men was rampant, far exceeding (as was only natural) the faithlessness of the Ases. A dreadful three-years' winter was followed by the swallowing up of the sun and moon, and in the darkness the earth gaped asunder and Loki and his terrible progeny were all released, and came up against Asgard. Muspelheim opened and all the sons of flame and smoke joined the giants and the Hrimthurles in the attack. Wotan himself perished in the jaws of the wolf Fenris, and the wolf was slain by Widar, the god of silence, Wotan's son. The gods and their enemies perished by each other; for instance, Thor slew the Snake, but died of her poisonous breath, &c. Finally Surtur, himself dying, gathered his mighty strength together and cast his flaming sword across Asgard, Midgard, and Utgard alike, and the whole universe was burnt up in one great purifying fire.

Many centuries rolled by, and there woke from sleep, under a new sun and a new moon, a youth and a maiden, Lif and Lifthrasir, who had wandered deep into the woods when the last battle had broken out, and being then little children had fallen fast asleep, and so remained, preserved by All-father to restore the race of man. From them all mankind is descended. The Ases, too, awoke from their long sleep, no longer sinful, but now bright and holy. It was indeed the resurrection which had come. The brothers Baldur and Hödur walked together, and the sons of Thor, with them, carried their father Thor's hammer, but now only as a consecrating symbol wherewith to weld and fusten all right and holy things, the marriage bond included—the avengers, Widar and Wali, were resting in peace; while Loki and his hateful children were nowhere to be seen, and the giants and other evil beings also had vanished in the flames of Surtur.

NORTH AMERICA is that portion of the American continent which is north of the Isthmus of Panama, in relation to South America. On the N. it is bounded by the Arctic regions, on the W. and S. by the Pacific, and on the E. by the Isthmus of Panama, the Caribbean Sea, the Gulf of Mexico, and the Atlantic. These boundaries, including the continental islands, are estimated to inclose an area of about 8,820,000 square miles, and a population of about 70,000,000. Next to Europe North America has the greatest surface of internal navigable water, with the greatest length of coast-line in proportion to area of any of the chief land surfaces of the globe. The latter has been estimated at as much as 28,000 miles. North America, in fact, is remarkable for the broad and deep indentations of its coast, such as the vast sea-like inlets of Hudson Bay, the Gulf of Mexico, and the Gulf of California, and for the number of its insular dependencies, some of which are of great extent, as Greenland, Iceland, Newfoundland, the Arctic series, the West Indies, Vancouver and Queen Charlotte islands. Along the western side of the continent imposing ranges of mountains, supported by extensive table-lands, stretch from north to south. On the eastern side a range of moderate elevation extends from the Gulf of St. Lawrence to the state of Alabama. Between these highlands are enormous levels, but slightly elevated above the sea, and from the base of the Alleghanies, in the east, to that of the Rocky Mountains, in the west, and from the Gulf of Mexico to the Arctic Ocean, the whole of North America is an immense plain, comprehending more than 8,000,000 square miles, with widely varying features, but with no irregularity

of the surface beyond a few low hills and gentle swells, while embracing extensive and perfectly flat tracts. Towards the foot of the Alleghanies and the shores of Hudson Bay the country is undulating and well wooded, but at the base of the Rocky Mountains there are, over an average width of 500 miles, the features of a true desert—a district covered with gravel, boulders, and granitic sand. Intermediate, extending through upwards of 1000 miles, and generally limited by the parallels of 30° and 50°, are prairie grounds, which form the chief part of the basins of the great rivers Mississippi and Missouri.

Mountains.—From the shores of the Arctic basin, near the mouth of the Mackenzie River, the Rocky Mountains extend 3000 miles southward to the Mexican plateau, with bare and rugged summits, steep on the side of the Pacific, sloping on that of the Atlantic, in Mounts Hooker and Brown attaining nearly 16,000 feet. Parallel to this range, on the side of the Pacific, extending along the coast from lat. 60° to the Gulf of California, are the Maritime Alps, with the culminating point of the United States in Mount Hood, 17,640 feet. From the Isthmus of Panama a series of table-lands rise to the great plateau of Mexico, the average elevation of which is not less than 7000 or 8000 feet. Here the volcanic peak of Popocatepetl (17,720 feet), overlooking the city of Mexico, is the highest summit of all Northern America. Secondary but locally important ranges occupy a considerable space on the opposite or eastern side of the continent. They include in the north division the Alleghany or Appalachian chain, a series of parallel ridges stretching from the Gulf of St. Lawrence, in a diagonal direction, to the state of Alabama, of moderate elevation in general, but containing a few summits, as Mount Washington in New Hampshire, which exceed the height of 6000 feet.

Prairies.—Though the term "prairie" strictly signifies a region destitute of timber, and is therefore the antithesis of the forest, it is applied in North America to lands to which it is not strictly appropriate, and which differ very much in character. Hence there are "timber prairies," though the wooded tracts bear no proportion in their extent to that of the open spaces between them. Other prairies, properly so called, being woodless, have distinctive names for the predominant vegetation—grasses or flowers—with which they are clothed. Their features differ in other respects, as the surface is often for miles as level as the top of a table, and then becomes billowy, while some are constantly dry and others are swampy. On some of the prairies in the more southern latitudes, as far as the eye can range it only rests on most beautiful flowers. This is the case especially in Texas, where the traveller may ride through them the entire day without observing change in the general aspect of nature. Many are intersected by streams and belted with wood, and thus offer the two essentials of water and timber to the settler, invite the land of industry to raise a homestead, and change them into corn-bearing lands. Another variety, the "grass prairie," answers to its name. Not a flower appears in sight for miles, but there is an expanse of verdure green as an emerald, now darkened in its hue by the slitting shadows of the summer clouds, and anon lightened by the returning sunbeams. Drove of bisons cover these meadows in compact masses, often a mile in length; they are the chief dependence of the Indian tribes. Deer are met with in herds of several thousands, supplying the frontier settlers with venison at every meal; and wild horses are seen in long columns of eight or ten abreast, shaking the ground with their tread. Of these vast plains there is an area of upwards of 2,500,000 square miles.

Rivers and Lakes.—In North America the inland position of the principal water-shed, the Rocky Mountains, furnishes great facility for hydrographic development on the Pacific; and here are the Colorado, entering the head of the Gulf of California; the Sacramento, discharging into

the harbour of San Francisco; and the Columbia, passing into the great ocean. Yet these are but brooks when compared with the rivers on the opposite side of the range, the Missouri, the Mississippi, and the St. Lawrence, which belong to the Atlantic; but these rivers, while naturally of greater magnitude, are inferior in practical value as arteries of communication to the Hudson, the Delaware, and the Potomac, on the east coast. The northern rivers, flowing to the realm of the polar ice—the Mackenzie, the Coppermine, and the Great Fish River—are of little note from their high latitude, being frozen up through nine months of the year; they can only be utilized in their brief summer by the boats of *trappers and the canoes of Indians and Eskimos.

The Mississippi ("Father of Waters") deserves the name, as by far the largest river in the northern section of the continent, and the longest in the world, estimated with the channel of its principal tributary, the Missouri. Little more than three centuries have elapsed since it was first seen by European eyes. It was in 1541 that De Soto, a bold Spanish adventurer who had gone out into the wilderness in search of gems, gold, and barbaric cities, met with the broad stream flowing through tangled forests, wide morasses, and far-spread prairies; but it was not actually traced to its source till the present century, long after steam communication had been established on its bosom.

In the north of the continent, almost every stream, small and large, pauses in its course to expand into ponds or lakes, which are so numerous that they are estimated to contain considerably more than one-half of the entire fresh water of the globe. The Great Lakes, as they are called, or the Canadian series, five in number, are expansions of the St. Lawrence, which, though called by other names in the upper parts of its basin, is strictly a single river, with a continued current through the reservoirs. They are properly inland seas, subject to all the vicissitudes which attend the navigation of the Baltic or the Black Sea, and form by their position a boundary between the territory and institutions of a monarchy and a republic, as the frontier line between British America and the United States is supposed to run through their centre.

Lakes.	Mean Length. Miles.	Mean Breadth. Miles.	Area. Square Miles.	Elevation above the Sea. Feet.	Mean Depth. Feet.
Lake Superior,	400	80	32,000	596	900
Huron,	220	70	21,000	578	1000
Michigan,	240	80	20,000	578	1000
Erie,	240	40	9,600	565	
Ontario,	180		6,300	232	500

Their united area exceeds that of Great Britain, and their total contents are estimated at upwards of 13,000 cubic miles of water. Between Lakes Erie and Ontario the connecting river has the name of the NIAGARA, and forms the celebrated fall. A second series of large expanses extends from near the preceding in a north-west direction—Winnipeg, Athabasca, Great Slave, and Great Bear Lakes—the first connected by the Nelson with Hudson Bay, and the remaining three by the Mackenzie with the Arctic Ocean. Owing to the high latitude they are regularly closed by the ice through the long winter, and travelled over on sledges by the fur-hunters. Lakes abound on the plateau of Mexico, and also in Central America, which are not of comparable magnitude.

Minerals.—The mineral wealth of North America is incalculable, and commercial enterprise is continually finding new sources of profit. The mines earliest worked for the precious metals were those of Mexico and Central America. Mercury, copper, lead, tin, zinc, iron, coal, are in abundance; sulphur, salt, marble, diamonds, and other precious stones are worked profitably in various parts, but Mexico, Central America, California, and British Columbia are famous for their yield of the precious metals.

Botany.—On the Arctic borders the vegetation grows so scantily that the dwarf willow, 6 inches in height, is the only representative of tree life. The most northern station in which vegetation has been discovered is Melville Island, 74° 50' N. lat. It is in these latitudes that the red snow plant exists in all its beauty. In the great fertile belt of Canada and in the United States the great features of the North American flora are at length assumed. The forests consist of pines and larches unknown in Europe, of many kinds of oaks, of locust-trees, black walnuts of enormous size, hickories, and ashes; among which the noble tulip-tree rears its towering head; in the swamps grow the deciduous cypress, the white cedar, certain fir-trees, the rhododendron, the glaucous kalmia, &c.; the sides of the mountains and hills are covered with the American arbutus, the sorrel, and the beautiful mountain laurel; and finally, the undergrowth of the woods and plains contains endless species of aster, and various species of the exclusively American genera liatris, phlox, gerardia, calycanthus, &c. Tobacco, maize, and wheat are the staple objects of cultivation.

The approach to a tropical climate is first indicated by fields of cotton and rice, which on the Atlantic side commence at no point that can be definitely fixed, but generally may be said to begin south of Virginia. The cactus is peculiar to tropical America, and the hothouse is never found as indigenous to the soil.

Zoology.—The quadrupeds proper to America are generally inferior in size to the larger animals of Asia and Europe. The largest are the elk, musk ox, reindeer, wapiti, and bison, commonly called the buffalo. The puma, the wolf, and the bear, are the beasts of prey. Rodents are very numerous and valuable, embracing the beaver, musk-rat, and ermine. The horse and the ox, introduced by Europeans, are now numerous, and wander wild by thousands on the prairies. Humming-birds are seen even in the temperate regions, while pigeons are characteristic from their numbers in North America. Wild bees are indigenous, but the hive bee has been introduced from Europe.

Climate.—North America, on the side of the Atlantic, and through the whole of its central districts, has a lower mean annual temperature than Western Europe in corresponding latitudes, with warmer summers and colder winters. The direction of the Gulf Stream, which carries its warm water away from the shores, while the prevailing south-west winds similarly divert from them the circumambient air, warmed by contact with the current; the great Polar Stream, which annually brings down the icebergs to the coasts of Newfoundland and Labrador; and the broad expanse of land towards the Arctic zone without mountains to prevent the free egress of the chill northern blasts, are supposed to combine to produce this effect. The western side of the continent, in its north division, is much warmer than the eastern, and has not the same extremes of summer heat and winter cold. Thus Sitka Island, New British Columbia, has a mean annual temperature of 45° Fahr., while at Nain, on the shore of Labrador, in the same latitude, it is only 28°. The different temperatures of the Pacific and Atlantic coasts is most perceptible in the winter months. The atmosphere is calculated to be more humid than that in corresponding latitudes in the Old World.

Political Divisions.—The political divisions of the continent are as follows:—Danish America—Greenland; British America—Canada, Newfoundland; United States; Mexico; Central America—Guatemala, Republic of Honduras, San Salvador, Nicaragua, Costa Rica, British Honduras; West India Islands—Jamaica (British colony), Cuba, Porto Rico (Spanish colonies), Hayti or San Domingo (independent); the Greater Antilles; and the Bahamas and Bermudas, numerous islands forming the Lesser Antilles.

History.—For history see AMERICA, and articles on the various states.

Inhabitants.—The greater part of the population are Europeans by descent, chiefly British, Spanish, and Portuguese, with a sprinkling of French; and newly arrived European settlers, among whom the Germans form an important body. The remainder consist of Indian tribes and Eskimos, of African negroes (formerly slaves), and of mixed races, the offspring of the European and the negro, the European and the Indian, the Indian and the negro. In Mexico and Central America the pure aborigines and the mixed races preponderate. The Eskimos, few in number, and limited to the far north, correspond to the north Asiatics, and are generally classed with the Mongolian division of the human race. The subject of the origin of the Indian races is one of the greatest difficulty. The only distinctions which mark them out as a separate branch of the human race undeveloped from any known Asiatic or African family are—their hair, which is cylindrical instead of oval in section, and their languages, of which there are more than 500 distinct varieties, but which have all a common characteristic, to which the term "polysynthesis" has been applied. It implies in a general way that these languages combine in a single word, a "bunch-word" as it is called, complex conceptions in other systems expressed by two or more separate terms. Thus the Indian can scarcely use even concrete terms apart from their associations; he cannot say to cover, to put on, to take off, but only to-cover-with-snow, to-put-on-an-apron, to-take-off-an-apron, or rather somebody-covers-somebody (or something) with-snow, with-earth, &c. Hence nothing puzzles him more than to be asked to give the equivalents in his language of isolated English words. He cannot translate to eat, to drink, to strike, because he never eats, drinks, nor strikes, but always eats something, drinks something, strikes somebody, in diverse and sundry ways, and looking on all this as a single concrete conception, naturally expresses it in a single concrete term. The result of course is that this concrete term must be conjugated, and that conjugation itself becomes interminable.

The Indian type approaches, perhaps, nearer to the Mongolian than to any other; its most prominent outward features are—body moderately tall and robust, though less so than either the white or the African, and inferior to them also in working power; cranium rather long, flat, and receding; forehead very broad, but also very low and depressed, narrower above than below, thus giving greater prominence to the middle and lower features than in the case of any other race; sockets of the eyes very large, the under rim more curved than the upper; eyes themselves long, but, as a rule, small, black, and deep-set, with corner directed upwards towards the temple; cheek-bone strong and projecting, with a marked inclination towards the under jaw; jaws themselves long and prominent, with large teeth; nose also large and somewhat curved and even aquiline; skin soft as satin to the touch, in colour changing from a dirty yellow to an olive-brown and copper—or, better, cinnamon—hue. Their constitution is remarkably weak under climatic changes or alteration in mode of life. Their more striking mental qualities are, perhaps, resolution and earnestness on the one hand, and on the other indifference to bodily pain and to external nature—an indifference, however, often more assumed than real, because by no means due to a heavy or unsympathetic temperament.

The Redskin is, on the whole, not deficient in personal bravery, a quality for which some nations, such as the Iroquois and Algonquins of the eastern seaboard, the Dacotahs and Pawnees of the prairies, the Jibaros of the Napo Valley, the Chilian Araucanians, and many others, are indeed conspicuous. But all are alike cruel and cunning in war, priding themselves more in circumventing the enemy than in overcoming him in open fight. Gener-

osity they are also strangers to, and know nothing of the more ennobling passions and feelings of human nature. To them love in its higher sense conveys no meaning. Of the comic vein also, so conspicuous in the African race, there is almost a total absence. On the other hand, the culture of the most civilized Indian was not only of native growth, but of a much higher order than anything developed by the Australasians, African negroes, or borrowed by the Malays of Java from the Aryan Hindus.

The white men who laid claim to the land which had been for ages the free hunting grounds of the Indians were naturally regarded by them with intense dislike. The various tribes disputed the advance of civilized life, harassed every new settlement, and aided with the enemies of the republic; a constant strife therefore ensued, in which deeds of merciless bloodshed were committed on both sides, but in which the red man was invariably beaten in the end.

It was ultimately considered by the United States government that, as it was neither possible nor desirable to stem the westward tide of population, the best course to pursue with the Indians was to allot them a distinct territory, where they could to a great extent pursue their old methods of livelihood by hunting, fishing, &c., or where they could learn and practise the arts of civilized industry. A special department for Indian affairs was formed, an "Indian Territory" set apart, and every encouragement was offered to induce the various tribes to migrate to and settle upon it. In all their arrangements the United States government recognized the considerations that the continent was originally occupied and owned by the Indians, who have on this account a claim to far more privileges than those offered to any newly-arrived foreigner who elects to become a citizen; that whatever is offered the Indian should not be in the nature of a gratuity, but as a compensating endowment, to which he is entitled on account of his original interest in the soil; and that inasmuch as the progress of industrial enterprise has cut those people off from modes of livelihood entirely sufficient for their wants and left them utterly without resource, they have a claim to such temporary support and assistance as may be necessary to enable them to ultimately obtain a livelihood by means compatible with civilization.

Great difficulties have been encountered in the settling of tribes accustomed to a lawless roving life, many of whom only consent to go on the reservations when thoroughly and often painfully convinced of the utter uselessness of further resistance to organized and armed authority. There is indeed a party in the States who hold the Indian to be incapable of civilization, and advocate the application to him of an invariably stern military law. The policy of lenity and humanity has, however, prevailed, and can now be judged by its fruits.

The Indians within the limits of the United States numbered 300,000 in 1880. Of these those who support themselves upon their own reservations, receiving nothing from government but interest on their own moneys, number about 130,000; those who are entirely supported by the government, 31,000; those in part supported, 84,000; those who subsist by hunting and fishing, upon roots, nuts, berries, &c., or by begging and stealing, about 55,000. Again, it may be said, that of the 300,000 Indians 180,000 have treaty reservations with the government; 40,000 have no treaties, but have reservations set apart by executive order for their occupancy, and are in charge of government agents; 25,000 have no reservation, but are more or less under control, and receive more or less assistance from government; the remainder are the 55,000 before alluded to. When we speak of treaty reservations it should be remembered that in 1871 Congress passed a measure declaring that "hereafter no Indian nation or tribe within the territory of the United States shall be acknowledged or recognized as an independent nation, tribe, or power with

whom the United States may contract by treaty;" so that treaties are now rather in the nature of agreements with newly-settled immigrants. In civilization, according to a standard of what might fairly be expected of a race with such antecedents and traditions, the Indians may be divided thus:—Civilized, 97,000; semi-civilized, 125,000; wholly barbarous, 78,000. Of the latter, however, the numbers of the actually hostile and depredating bands, such as Apaches, Comanches, &c., do not exceed in the aggregate 8000, and these are very rapidly diminishing.

The Indian territory, where the principal civilized Indian tribes are located, is situated to the west of the states of Arkansas, Missouri, and Iowa, and contains 70,000 square miles, or a larger area than the six New England states combined. In agricultural and pastoral advantages and delightful climate it is unsurpassed by any section of the country. Corn, wheat, and the best of fruits are produced, and coal, iron, lead, zinc, copper, and salt and petroleum springs abound. The principal tribes occupying this country are the Cherokees in the north, the Creeks and Seminoles in the middle, and the Choctaws and Chickasaws in the south; they are known as the five civilized tribes, and all of them, except the Seminoles, have a written constitution and code of laws. The Choctaws and Chickasaws have between them four high schools and forty-eight neighbourhood day schools. The Cherokees support forty public free schools and two high schools. The latter tribe includes a number of Shawnees and Delawares. Besides the civilized Indians the savage tribes of Kiowas, Arapahoes, Cheyennes, Comanches, Osages, and others, have reservations in the Indian territory, the total population of which is 70,650. For some years a practice prevailed on the part of unscrupulous squatters of settling upon and appropriating portions of the Indian territory, but in 1879 the Indians petitioned Congress on the subject, and in the following year very prompt measures were taken to remove the intruders and to prevent any further molestation of the tribes. In other places also, within the limits of organized states and territories, where there are numerous and still formidable tribes, the government has marked out Indian reservations, on which it compels the savages of each particular district to live. Here they are supplied with the necessities of life, with blankets, clothes, and even guns and ammunition, by the Federal authorities; the Indian agent attends to their wants, and the force at the United States fort keeps them in order. Soon after the disturbances of 1873 the Modocs were removed to the Indian territory; and in 1878 the entire body of the Sioux were removed from the Black Hills country to the reservations on the Missouri and its tributaries, and placed under thorough military control, in the hope of completely ending the Indian wars and of making the most powerful of all the Indian tribes tractable and friendly.

In Canada there are still considerable remains of once powerful tribes of Iroquois, Hurons, Mic-Macs, Ojibewas, Crees, &c. They mostly pursue peaceful avocations, and have either adopted the agricultural habits of white settlers, or in the more northern parts live by hunting and fishing. Since the consolidation of the Dominion the various tribes that are of any numerous extent have entered into very liberal agreements offered them by the "great mother," and many of the settlements wear a very flourishing aspect.

NORTH BERWICK. See BERWICK, NORTH.

NORTH CAPE, the most northern point of Europe, on the island of Magerö, off the north point of the mainland of Norway, in lat. 71° 10' N., lon. 25° 46' E. The island rises to the height of 1161 feet, and descends northwards to the ocean in a steep cliff. The top of this cliff is 950 feet above the sea, but there is no particular grandeur of scenery or great swell of the waves. The summit is a bare moor. The limit of the snow-line here is about 2000 feet. In this latitude the sun does not set for seventy-

seven of our days (14th May till 30th July); and the night at the opposite season (16th November till 27th January) lasts for seventy-three revolutions of the earth on its axis.

NORTH CAROLINA. See CAROLINA, NORTH.

NORTH POLE. See POLE, NORTH.

NORTH SEA, or the **GERMAN OCEAN**, is separated from the Atlantic by the British Islands, which form its western limits, and on the opposite side by Norway and Denmark from the Baltic. To the southward it is bounded by the coasts of France, Belgium, Holland, and Germany; and to the northward an open space between the Shetland Isles and the Norwegian province of Bergen unites it to the Polar Sea. With the Atlantic it is connected through the Straits of Dover by the English Channel; and with the Baltic by the broad gulf called the Skager Rack. It extends across 10 degrees of latitude and 11 degrees of longitude; its greatest length may therefore be taken at 600 geographical miles, its extreme breadth at 350, and its superficies at about 140,000 square miles.

On its north-eastern side the shores are bold and rocky, but in most other parts they are low and sandy. The sand from the rivers is swept by the alternate flood and ebb into long, sinuous, and shallow banks, which rising in narrow ridges towards the surface, place themselves in directions parallel to the contiguous shores. All these shoals and banks obstruct free navigation, and combined with the stormy and foggy character of the climate, have led to many wrecks. Among other sandbanks are those designated the Long North Bank, the Dogger Bank, the Well Bank, and the Broad Fourteens. The deep holes which are found in this sea form another of its singular features; the chief among them are the Little Silver Pit, the Great Silver Pit, and the North-north-east Hole. In these pits the depth of water is very great.

One island only interrupts the uniformity of this sea, Heligoland Rock, which lies off the mouth of the Elbe, unless the Bell Rock and the May Rock, situated in the opening of the Frith of Forth, may be so called: on each of these three insulated spots lighthouses have been erected. The abundance of fish in the German Ocean has in all ages been celebrated, and the protection of its fisheries has given rise to more than one national quarrel.

The course of the tides in the German Ocean is extremely varied and complex.

NORTH, FREDERICK, second Earl of Guildford, but better known by his courtesy title of Lord North, an English prime minister, was born 13th April, 1733. He was educated at Eton and at Christ Church, Oxford, and at the age of twenty-two was elected M.P. for Banbury, a town he continued to represent in Parliament for nearly forty years. In 1759 he was chosen by the Duke of Newcastle to be a lord of the Treasury, and in 1766 he became paymaster-general under the Duke of Grafton. In 1767 he was made chancellor of the exchequer, and in 1770, on the fall of the Duke of Grafton, he became first lord of the Treasury. His tenure of office, which lasted until 1782, covered one of the most eventful periods of English history, and unhappily he consented to become the mere mouth-piece of the king, George III., who had succeeded in obtaining a purchased majority in Parliament, and whose blind obstinacy led to the loss of the American colonies. When the War of Independence broke out Lord North earnestly counselled peace, but yielded to the king's determination, and consented to defend and continue a war which he knew to be both impolitic and hopeless. In 1782, after the surrender of Cornwallis, he resigned, but the following year he consented to a coalition with Fox, and when a ministry was formed by the Duke of Portland, was with him appointed a secretary of state. This ministry went out of office at the end of 1783, and Lord North then finally retired from political life. He succeeded to the title of

Earl of Guildford on the death of his father in 1790, but died two years afterwards (5th August, 1792), in the sixtieth year of his age.

Lord North possessed strong common sense, consummate tact, a pungent wit, and an imperturbable good humour, but he is not entitled to high rank as a statesman. His public measures were often both arbitrary and impolitic, and the original injustice of the American War was greatly aggravated by the manner in which it was conducted.

NORTH, ROGER (1650-1733), known as the attorney-general of James II., was the youngest son of Dudley, Lord North, and brother of the lord chancellor of Charles II. He has left some invaluable gossip books, full of anecdotes of his own times, and throwing light upon the Popish Plot and the inner history of the later Stuarts; "Examen, an inquiry into the credit and veracity of a pretended compleat History of England," published 1740, the "History" being that of the Bishop of Peterborough; the "Lives" of his three brothers, published 1742; "Memoirs of Musick," written about 1730, published 1846, &c.

NORTH, SIR THOMAS (1535-85 or later), was one of the band of diligent translators who enriched our stores of literature under Elizabeth. His chief works were the versions of Guevarra's "Diall of Princes" (1557), of Doni's "Moral Philosophie" (1570), which was an Italian translation of the Arabian book of fables, *Calilah-i dunnah*, and of Plutarch—both the "Lives" and the "Morals" (thirteen vols., 1579). North did not translate direct from the Greek, as even a cursory inspection will show; but from the French version by Jacques Amyot (1567). The "Lives of the noble Grecians and Romans" is a racy piece of Elizabethan English, and in many respects has never been surpassed as a rendering of Plutarch. It is immortalized as being the source whence Shakspeare, who was fifteen years old when it was published, drew his knowledge of the history of Rome.

NORTHALLERTON, a market-town of England, in the county of York and 32 miles N.N.W. from York city, and 221 from London, with a station on the North-eastern Railway, is situated on the Wiske, an affluent of the Swale, and consists chiefly of one long and wide street, with the parish church, a cruciform building with a central perpendicular tower, at the north end. The chief branch of industry is linen weaving. The town occupies the site of a Roman encampment, of which some inconsiderable remains are extant. A castle, built here by the bishops of Durham, was razed to the ground by Henry II. A palace, occupied at different times by Edwards II. and III., has also ceased to exist. The grammar-school, of great antiquity, has produced several eminent men; among others, Rymer, the editor of the "Fœdera." Races are held at Northallerton every October. The borough contains several public buildings, including a town-hall and market-house, opened in 1874. The great "battle of the Standard," in which the Scotch were totally defeated by the northern barons, was fought on a field 3 miles north of this place, in 1138. The town returned a member to the House of Commons until 1885. The population in 1881 was 5445.

NORTHAMPTON, an inland county of England, is bounded N. by Lincolnshire, N.W. by Rutlandshire and Leicestershire, W. by Warwickshire, S.W. and S. by Oxfordshire, S.E. by Buckinghamshire and Bedfordshire, and E. by Huntingdonshire and Cambridgeshire. Its greatest length north-east to south-west is 69 miles; its greatest breadth north-west to south-east is 27 miles. The area is 984 square miles, or 629,912 acres. In 1881 the population was 272,524.

Surface and Rivers.—The surface of the county is undulating; the hills do not rise to a great height, but present gentle declivities separated by intervening vales watered by rivers and rivulets. The highest land is about Daventry, where Arbury Hill is 804 feet above sea-level.

The eastern border of the county is occupied by the Oxford clay, which forms the separation between the middle and lower divisions of the Oolitic series. The rest of the county is chiefly occupied by the uppermost formations of the lowest division of Oolites. Slaty beds of the Forest marble, lime, and brick clay occur in various places, and iron is largely worked.

The greater part of the county belongs to the basin of the Nen, which is the principal river in it. A small portion of the north and north-west borders belongs to the basin of the Welland; another small portion, on the west side, to the basin of the Severn; and the southern extremity of the county to the basins of the Ouse and the Thames. The Nen flows past Northampton, Wellingborough, Thrapston, and Oundle to the borders of the county, receiving the Isc, Harper's Brook, and Willow Brook. The Welland is principally a boundary river, receiving but few tributaries from Northampton. The streams belonging to the basin of the Severn are the Avon, which rises near Naseby, and has the upper part of its course in this county; and the Leam, which also has a few miles of the upper part of its course on the border. The streams belonging to the basin of the Ouse are the Ouse and the Tow. Those belonging to the basin of the Thames are the Cherwell or Charwell, which rises at Charwellton, 5 miles south-west of Daventry, and some of its tributaries.

Portions of the Grand Junction, Oxford, and Grand Union canals are in this county. The North-western, the Leicester and Peterborough, the Midland, and the Great Northern railways, also pass through the county.

Soil and Agriculture.—Northampton has many advantages in point of climate and soil, and the latter has for a long time been comparatively well cultivated and productive. It is generally adapted to produce both corn and pasture of a superior quality.

The richest land in the county is perhaps the black mould of the fens, when they have been drained and cultivated; but the most desirable for the farmer is the brown crumbling loam of the uplands. Where this is of a sufficient depth, it will produce, with little trouble, abundant crops of wheat, beans, barley, and oats, and it is peculiarly adapted for turnips and all green crops. The pastures are both rich and sound, and the cattle grazed in them in summer repay the capital laid out on them with good interest; while those which are kept on turnips in the yard, to be turned out in summer, or are stall-fed to bring them to a marketable state, convert the straw, which is abundant, into a rich manure.

According to the official agricultural statistics, published in 1885, the area under cultivation was 560,000 acres. Corn was grown on 160,000 acres; green crops on 40,000 acres; and 300,000 acres were permanent pasture or grass land. The number of cattle in the county at the same time was 120,000, and of sheep 420,000.

The permanent pastures are very good in most parts of Northamptonshire, and grazing is in consequence one of the principal objects of the farmer. There is no characteristic native breed. The sheep most common in the rich pastures is the improved Leicester, but in many parts they are being rapidly superseded by half-bred Downs. In consequence of the increased demand for unskilled labour in many of the towns of Northamptonshire, the wages of the agricultural labourers have shown a marked rise during the last few years.

Manufactures.—Northampton is the chief seat of the boot and shoe trade in England, and it is carried on in all the small towns and villages around. There are large iron furnaces at Blisworth, Wellingborough, Glendown, and Weedon.

Divisions.—Northamptonshire is divided into nineteen hundreds. It is in the diocese of Peterborough, with the exception of a small portion of the county on the south-west

border, which is in that of Oxford. It is in the Midland circuit, and the assizes are held at Northampton. Under the Redistribution of Seats Act of 1885, the county returns seven members to the House of Commons—four for single-member divisions of the county, two for the borough of Northampton, and one for Peterborough.

History, Antiquities, &c.—In the earliest division of the island it is doubtful whether this county was a portion of the dominions of the Coritani, the Catycuchani, or of the Icenii. In the Roman division of Britain Northampton was included in the province of Flavia Caesariensis. Indications of Roman residences or posts may be traced in various parts of the county.

The county was included in the Anglian kingdom of Mercia in the times succeeding the English Conquest. Both Henry III. and Edward I. frequently resided at Northampton; and in the reigns of Edward II., Edward III., and Richard II., several Parliaments were held here.

Of ancient ecclesiastical, monastic, or castellated architecture, the county possesses several specimens. Brixworth Church, between Northampton and Market Harborough, is one of the most remarkable.

Its castellated ruins are few. These are the earthworks of Northampton, Higham Ferrers, Brackley, Fotheringay, and one or two others, and the gateway of Rockingham.

In the reign of Queen Elizabeth this county was the scene of the execution of Mary Queen of Scots, who was tried, condemned, and beheaded in Fotheringay Castle, which was entirely demolished by order of James I. when he came to the throne. The battle of Naseby, which decided the civil war of Charles I., was fought in 1645.

NORTHAMPTON, the chief town of the above county, and a municipal borough, is situated on the north bank of the Nen, 67 miles north-west from London by the North-western and Midland railways. The town consists of several streets irregularly laid out, the two principal of which intersect at right angles. The houses are well built, chiefly of stone. The market-place is a large open area in the centre of the town. Among the principal edifices are—the shire-hall, a spacious building of elegant Grecian architecture, county goal, theatre, barracks, infirmary, grammar and corporation schools, mechanics' institute, and a very handsome Gothic town-hall, erected in 1864. The corn exchange is a good modern building in the Italian style. All Saints' Church is a building of incongruous architecture, having in the centre a cupola supported on four Ionic columns. At the west end is the original embattled tower. St. Giles', a large cross church with portions of various styles, has been restored and enlarged. St. Sepulchre's was built in the twelfth century, and is one of the few round churches in the kingdom: it underwent a thorough transformation in some parts in 1865, under the directions of Sir G. G. Scott, but its most interesting features have been preserved. There is a Roman Catholic cathedral and several dissenting chapels. The principal branch of trade carried on in the town is boot and shoe making, employing about 3000 hands. The articles are sent to London and other parts of England, or are exported. Considerable business is done in currying leather; and stockings and lace are made. There are iron foundries, and also some large breweries. A large cattle-market was opened in 1873. The trade of the town is facilitated by the navigation of the Nen, as well as by the railways. The municipal borough is divided into three wards, and is governed by six aldermen and eighteen councillors. The parliamentary borough returns two members; the population in 1881 was 57,544.

After the Norman Conquest *North Ham-tune*, which, according to the Domesday Survey, had then only forty burgesses, was given by William I. to Simon St. Liz, who built a castle (now marked only by an earth-mound, on the west side of the present town). Numerous synods and

parliaments met here during the succeeding reigns, and at the beginning of the thirteenth century Northampton was considered of sufficient importance to have a mint. In the reign of Henry III. an attempt was made to establish a university here, consisting of immigrant students from Oxford and Cambridge; but though the scheme was at first sanctioned by the king, a mandate was afterwards issued to compel the students to return to their old seminaries, and to forbid the continuance of the establishment. In the Wars of the Roses its neighbourhood was the scene of a great battle (fought 10th July, 1460) between Henry VI. and the Earl of March (afterwards Edward IV.), in which the former was defeated and taken prisoner. In 1642 the town was seized by Lord Brooke, who fortified it for the Parliament. In 1663 Northampton suffered greatly from a flood, and in 1675 was nearly destroyed by fire, the loss of property being estimated at £150,000.

NORTHAMPTON, ASSIZE OF, one of the principal portions of the great feudal legislation of Henry II. It was held in 1176, and the enactments then made were in thirteen articles, chiefly concerned with the regulation of the law courts and business and with the maintenance of peace. The first article is curious, as it condemns anyone "presented" to the judges by the oath of twelve knights of the Hundred or of twelve lawful freemen to the *ordel by water* [see ORDEAL], and to *lose a foot*, if thereby convicted, the crimes thus punishable being murder, robbery, arson, and forgery. The second is also very remarkable, forbidding any resident in a town to give shelter to a stranger more than one night without good reason; and when the stranger departs it must be openly in the sight of all men. This points to great insecurity in the realm, as evidently the machinations of plotters are thought to be thus defeated. This presumption is strengthened by the contents of the eighth and eleventh articles, commanding the demolition of castles and strict inquiry as to the owners of them, dismantled or not. Many feudal customs, mort d'ancestor, novel disseisin, homage, &c., are also dealt with in this fine old piece of legislation.

The *Council of Northampton* must be distinguished from the above. This latter was what we should now call a Parliament (but of barons only), and was convened in 1165 to denounce the continued continuance of Thomas A'Becket. See BECKET.

NORTHAMPTON SAND, a division of the INFERIOR OOLITE, well developed in the north of Oxfordshire, Northamptonshire, and Lincolnshire, and resting immediately upon the Upper Lias. It rarely attains a greater thickness than 20 or 25 feet, but the formation is especially important as yielding large quantities of silicious ironstone. Towards the north-east its upper beds are replaced to some extent by the Lincolnshire limestone, and both here and in the Northampton area the immediately overlying strata consist of estuarine deposits of Great Oolite age. The iron ores are largely worked for smelting in Northamptonshire.

NORTH-EAST and NORTH-WEST PASSAGES, the names given to the routes by which navigators have attempted to reach Asia from Europe round the northern shore of the continent. The exclusive policy of the Spanish and Portuguese, and the tales of the fabulous wealth of the East which spread after the passage to India and China round the Cape had been discovered, led the peoples of northern Europe to turn their attention to the finding of a route by which the East might be reached without passing through Spanish or Portuguese seas. The expeditions for this purpose have been very numerous. The first in search of a North-east Passage was sent out from England under Sir Hugh Willoughby in 1553, but it was not until 1879 that Professor Nordenskiöld, having sailed from Gothenburg in the previous year, reached Cape East, the north-east corner of Asia, and proved that, at

least in favourable years, steamers might make the passage in safety.

The earliest English expedition in search of a North-west Passage took place in 1576 under Martin Frobisher, but little more than a gold fever, owing to the fancied discovery of that ore, resulted from his voyage. In the present century McClure, while engaged in a search expedition for the Franklin party, made his way from Behring's Straits to Melville Island in 1852, but this journey was only accomplished by the party travelling over the ice, having left their ship fast frozen up. See also POLAR REGIONS and POLAR VOYAGES.

NORTHERN CIRCARS. See CIRCARS.

NORTHERN LIGHTS. See AURORA BOREALIS.

NORTH MEN is the general title given to the invaders of Scandinavian race who preyed upon the shores of the North Sea during the eighth and succeeding centuries. They were usually called Danes in England, though in all probability the invasions of Northumbria and northwards were wholly due, and the southern inroads were partly due, to Norwegians, as well as to Danes proper; and they were called Northmen or Normans in France, where more probably the Norse element was much less, and the Danish element much more, than in England. There in 913 Rolf the Ganger, a hero of Norse descent, leading Danes mixed with Norwegians, was recognized as the conqueror of Normandy, which became a fief under Rolf as first *Dux Terre Northmannorum*. [See NORMANDY.] A little before this (878) our own Alfred the Great had been forced to make a treaty with Guthorm the Dane, giving up the northern and eastern parts of England to these invaders, who from about 870 had made their footing quite permanent on our eastern shores. [See DANES; DANELAGH; EAST ANGLIA.] From 1012 to 1041 all England was subject to the sway of Danish monarchs.

NORTHUMBERLAND, the most northern county of England, is bounded E. by the German Ocean, S. by the county of Durham, S.W. by Cumberland, and N.W. by Berwickshire and Roxburghshire. Its greatest length N. to S. is 60 miles, and its greatest breadth E. to W. is 45 miles. The area is 2016 square miles. The population in 1881 was 434,024.

Surface and Rivers.—Northumberland is a rugged county. The highest hills are on the north-west border, towards Scotland. They are commonly designated the Cheviot Hills, which name is in strictness limited to one group among them. They extend from the neighbourhood of Wooler towards the south-west. The Cheviot Hills, properly so called (2676 feet high), are near the northern extremity. These hills have in several instances a conical form, and some are nearly perfect cones; they are covered with a fine green turf, and afford excellent pasture for sheep. Another range of hills, nearly parallel to that just described, extends from the east of the junction of the Till with the Tweed southward to the bank of the Tyne. The hills south of the Coquet form part of the extensive moorlands which occupy a third of the county, and have an average elevation of from 500 to 1000 feet above the level of the sea. There are not many hills south of the Tyne.

There are no cliffs on the coast, except very low ones, throughout its whole range. From the mouth of the Tweed at Berwick it runs south-east to Sunderland Point. In this part are two bays; the larger, opposite Holy Island; the other, Buddle Bay, into which a little stream, the Warnburn, flows, is more to the south-east. From Sunderland Point the coast runs south by east to the mouth of the Tyne.

The south-eastern part of the county, bounded by a line drawn from Warkworth, at the mouth of the Coquet, by the head of the river Blyth, to the Tyne, and thence southward to the bank of the Derwent, is included in the

great coal-field of the counties of Northumberland and Durham, which now yields nearly 32,000,000 tons per annum. This coal-field is skirted on the north-west by a narrow belt of millstone grit. Beyond this district extends a still narrower belt, occupied by the carboniferous or mountain limestone. Nearly all the rest of the county consists of a series of formations comprising sandstones of various kinds, limestone, slate, clay, shale, and coal.

The rivers of Northumberland rise for the most part in the eastern slope of the hills of the north-western boundary, and flow eastward across the county to the German Ocean. The Tweed lies to the west of this range, and belongs chiefly to Scotland. The chief among the rivers are—the Till, the Alne, the Coquet, the Wansbeck, the Blyth, the North Tyne, and the South Tyne, all of which have many small tributaries. The river Tyne is formed by a junction of the North Tyne and South Tyne near Hexham, and flows thence 30 miles past Newcastle to the sea.

The salmon fishery of the Tweed is very important, and a considerable number of boxes of that fish packed in ice are sent to the London market.

The railway communications of Northumberland centre in the town of NEWCASTLE.

Soil and Agriculture.—The position of this county causes the climate to be considerably colder and the harvest later than in the southern and midland counties.

Along the coast, and for some miles inland, the soil consists of a strong, fertile, clayey loam, well adapted to the growth of wheat, beans, and clover, and there are some excellent natural meadows and pastures. Along the banks of the Tyne and the Coquet, and the Alne from Alnwick to the sea, it is chiefly a light gravel, sand, or dry loam, which likewise prevails to a great degree in the vales of the Beannish, Till, and Beaumont. In the middle and south-eastern parts of the county it is a moist loam on a cold impervious clay bottom, which is of inferior value until it has been improved by draining and careful cultivation.

The county of Northumberland has been one of the foremost in England in adopting the improved system of agriculture, the chief feature of which is the cultivation of turnips for the rearing and fattening of cattle. Turnips, accordingly, occupy a large proportion of every farm, the soil of which admits of this cultivation. So great has been the advantage derived from this change from the old triennial system, that many fields now yield heavy crops of this useful root, which in most other parts of England would be considered as totally unfit for its cultivation. This has arisen from the early adoption of the culture in rows on elevated ridges.

According to the official agricultural statistics published in 1885, the area under cultivation in that year was 710,000 acres. Corn was grown on 123,000 acres, wheat on 54,000 acres, and 430,000 acres were permanent pasture. The number of cattle in the county was 100,000, and of sheep 920,000.

The cattle in Northumberland are generally of good breeds, mostly short-horned. Those bought to fatten are chiefly Scotch. The cows kept for the dairy are almost invariably of the short-horned Durham breed, and many remarkably fine heifers are reared. Excellent farm horses, active, with clean legs, and very muscular and hardy, are bred. The sheep, chiefly of the native Cheviot breed, are of a useful hardy kind, with a small fleece of moderate wool. A cross between a Cheviot ewe and a long-woolled ram produces a useful breed, improved in the carcase and in bulk, if not in the fineness of the fleece. There are no very extensive old woods, but many thriving plantations, as there is a constant demand for small timber for the use of the coal mines. Manufactures are various and important, but are chiefly confined to NEWCASTLE.

Divisions.—Northumberland is divided into nine wards. It is in the diocese of Newcastle. The county is in the

northern circuit, and the assizes are held at Newcastle. Under the Redistribution of Seats Act of 1885 the county returns eight members to the House of Commons, four for single member county constituencies, two for Newcastle, and one each for Morpeth and Tynewmouth.

History and Antiquities.—In the earliest period of the history of Britain, the eastern side of this county and the adjacent parts of Scotland were inhabited by the Otadini. On the west of the Otadini, in Northumberland, Cumberland, and Galloway, were the Gadeni.

When the English invasion took place, this part of England, *north of the Humber*, was conquered and colonized by the Angles, who made their first landing under their chief Ida, at Bamborough Head, in 547, and called their acquisition NORTHUMBRIA. The history of this kingdom is detailed in the article of that name.

In the later invasion of the so-called "Danes," a mixture of Danes and Norwegians, the Danes for the most part settled in Deira, the southern part of Northumbria, which is now called Yorkshire. The northern part largely remained under its English rulers. Its people were left little changed by any mixture of foreign blood; and the men who dwell between the Tyne and the Forth may still claim to be of purer English race than any other dwellers in our island. In the course of time the land between the Tees and Tyne was given to the great Church of Durham, and formed a county by itself. The land between the Tweed and the Forth was handed over to the Scottish king because he could govern it most easily, and the present county now represents the centre only of the once powerful kingdom of Northumbria.

There are several remains of the primitive inhabitants of the country, consisting chiefly of rude hill-forts, cairns, and Druidical monuments. Of these British remains, one of the most remarkable is on Yeavering Bell, near Wooler, where the nearly level summit of an oblong mountain, which rises 1172 feet above the adjacent plain, is encircled with the remains of a wall built of large flat whinstones without mortar, and inclosing a considerable area. The medium breadth of the ruined wall is 8 feet. Between the village of Hilderton and Hedgerope, one of the border hills, is a Druidical monument consisting of ten large rude and unequal stones, arranged so as to inclose an oval area of 38 yards from east to west by 33 from north to south. There are several remains of Roman encampments. The most remarkable monument of the Roman dominion is the great line of defence formed and augmented by the successive labours of Agricola, Hadrian, and Severus. Agricola, who commanded in Britain as viceroy for the Roman emperors Titus and Domitian, from 78 to 84, ran a closely connected chain of forts along his extreme northern frontier, that is between the friths of Forth and Clyde, from near Edinburgh to near Dumbarton, about 36 miles—the limit of the old Northumbria. But the fierce Picts drove back the Roman frontier, and when Hadrian came over in 120 to visit his province of Britain in pursuance of his plan of personally visiting the whole of his vast empire, the frontier was from the Tyne to the Solway. There is reason to think that Agricola also had thrown a dyke across the island at this place. In 121 Hadrian caused a wall (*vallum*), that is a dyke or great earthwork, with a ditch, to be constructed along this 80 miles of frontier from near Newcastle to near Carlisle. But later, when Antoninus Pius was emperor in 139, the General Lollius Urbicus advanced again far enough to build a wall along Agricola's lines, from the Forth to the Clyde. The tide once more turned against the Romans, and the last wall the Romans built was a new stone wall along the line of Hadrian's dyke from the Tyne to the Solway, made by the Emperor Severus in person from 207 to 210. It was finished the year before he died (at York), and it ran from Wallsend to Bowness. Battlements extended over a very large part, and there

were many towers to contain soldiers. Much of this wall was still standing in the last century, when it almost all disappeared, being pulled down to mend the roads.

Of many centuries of strife and consequent misery this county contains its stern memorials. The ruins of Norham and Wark castles still overlook the Tweed, and those of Heton, Dudhope, and Ford rise on the banks of the Till or its tributary streams. Bamborough and Dunstanborough castles are on the coast. In the interior of the county are Alnwick and Warkworth castles. The ruins are extant of several other feudal strongholds in various parts of the county. Prudhoe Castle, on the south bank of the Tyne, between Newcastle and Hexham, is one of the finest; it stands on a precipitous bank of the river 60 feet high. Of Hulne Abbey, close to Alnwick, there are some relics. Brinkburn Priory, near Rothbury, for regular canons of St. Augustine, has been in great part demolished. Ruined churches or chapels are still standing at Old Berwick, situated between Alnwick and Wooler; Manner-Kirk, near the border of Scotland; Bothall, near Morpeth; and Jesmond, near Newcastle. In the troubles of Charles I.'s reign this county suffered considerably.

NORTHUMBRIA, the great English settlement in Britain, was the work of the Angles, who landed at Bamborough in fifty ships, under Ida, in 547. With Mercia and East Anglia, both foundations by the Anglian nation, it made up so much of the island that it is little wonder we have taken the name England and not Saxony, although the Saxons were the first to arrive. (The Welsh, however, call us Saxons, *Sassenach*, to this day.) Northumbria soon formed a kingdom of great extent, comprising indeed all the conquered land *north of the Humber*, right up to the Frith of Forth. Edinburgh (= Eadwinesburh) was the capital of the great Northumbrian King Eadwine or Edwin. All the Scottish Lowlands are part of ancient Northumbria, and the dialect called Scottish is truly Anglian, and has a better title to be called English, if purely be considered, than the altered speech of the south. The Gaelic is, of course, the original language of the country, and has almost nothing to do with what is commonly called Scottish. In fact in the Highlands the Lowlanders are called Saxons, just as are the Englishmen by the men of Wales. This great Northumbria was made up of Ida's own kingdom of Bernicia (to the north) and Deira (to the south), York being the capital of the latter. The two subkingdoms were sometimes ruled together and sometimes apart. Their union under Æthelfrith (593) made them a powerful state, and the first to take any commanding position in the conquered country. At Deagsastan the Britons were simply annihilated (603), and the whole of Northumbria was now thoroughly in the hands of the Angles. In 607 Æthelfrith touched the western coast by his great victory at Chester, cutting off the "Welsh" of Strathelyde and Cumbria from those of North Wales. He was now powerful enough to be regarded as Bretwalda or overlord over all the various kingdoms of the middle of England, and was preparing to bring into submission the Jutish kingdom of Kent when he fell in a petty skirmish in East Anglia (617), while engaged on an expedition against Eadwine, a kinsman and the rightful heir of Deira, whom he had banished. It was Eadwine, however, who succeeded him, and who not only founded Eadwinesburh, in the extreme north, but quelled all the kingdoms to the south, so that he was lord of all Britain. Kent alone preserved a nominal independence by the great king's favour, for Kent was the country of his wife Bereta. This princess had brought northward with her Paulinus, a follower of Augustine, who had the good fortune to convert not only the willing Eadwine, but all his people to Christianity (627). Eadwine perished at Hatfield in 638, in an attempt to quell a revolt of the heathen kingdom of Mercia, which had risen, under King Penda, both against his overlordship and against his new faith.

Oswald, a pupil of the Irish monks of Iona, called to them when he ascended the throne, and found Paulinus and his companions had fled before the Mercians. The famous monastery of Lindisfarne or Holy Island, off the Northumbrian coast, was founded by the good monks of Iona in response to his call, and it was to this source, not to the direct missionaries of Rome, that the permanent Christianizing of Northumbria was due. All his life Oswald strove for his own kingdom and those of his neighbours to keep the new faith. Gradually the Northumbrian overlordship began to reassert itself; and Oswi, who succeeded in 642, found himself powerful enough to encounter the great Mercian king Penda, in 655. At the battle of Leeds he was completely victorious, and Penda fell. The ensuing peace was the time of the missionary labours of St. Chad (Ceadda) in Mercia and St. Cuthbert in Northumbria, and of the noble poem of Caedmon. At the synod of Whitby (664) Northumbria (and with it of course all England) returned to the Roman obedience, and the monks of Iona, with their own free usages, were sent back to their remote Scottish monastery. England was at once reorganized as a province of the church by the Greek monk Theodore, sent from Rome for that purpose. Mercia was now rapidly coming forward, and even attempted to subdue Northumbria under Egfrith (670). But this only ended in Egfrith's renewed supremacy. Under him Northumbria sprang to her highest power. He made all Cumbria English ground, and brought St. Cuthbert to Carlisle as his bishop. His reign was full of power and success, until in a great expedition into Scotland beyond the Forth, he perished in a battle at Nechtansmere, Fife. Cuthbert returned to Holy Island to die, and the overlordship of Northumbria, which had lasted for some eighty years, suddenly gave way to that of Mercia, which was fated in its turn to pale before the greater star of Wessex. In 827 Egbert (Egberht) of Wessex conquered Northumbria, the last of England to resist his overlordship; and he was fairly entitled to call himself "King of the English."

In 918 Eadred, king of England, having quelled a serious revolt in Northumbria, made it into an earldom. About 966 the Lowlands were granted, on some sort of feudal tenure, to Kenneth, king of Scots, by Edgar, king of England, and the same king divided the remainder of Northumbria into the two earldoms of Deira and Northumberland. The earldom grew to great power in the hands of Siward, who died in 1055. Tostig, one of the great Earl Godwine's sons, ruled it after Siward, but was driven out for tyranny. Morkere, the next earl, and his brother Edwin, the earl of Mercia, were degraded as traitors to all time, for the way in which they held back the north from coming to King Harold's help at Senlac, and for their share in the Norman Conquest thereby. One is glad when they perish miserably a few years later, but unhappily not until their treachery against their new king had drawn down upon Northumbria that terrible devastation at the Conqueror's hands (1068) which cost over 100,000 lives, and made the whole land a desert for half a century.

NORTH-WEST PASSAGE. See NORTH-EAST and NORTH-WEST PASSAGES.

NORTH-WEST TERRITORY, the region formerly known as the Hudson Bay Company's Territory, North America, includes the vast region extending from the northern frontier of the United States and Canada to the Arctic Ocean, and from the river watershed of Labrador to the Rocky Mountains on the west, over an area of more than 2,500,000 square miles. The accounts of this territory must be received with caution, as most information is derived from sources where interest makes the favourable points more visible than the unfavourable. In the extreme north the country is a barren Arctic waste, chiefly profitable as a hunting-ground of fur-yielding animals; but when once this is passed the surface consists of vast

fertile prairies and magnificent forests. These valuable lands are traversed in every direction by navigable waterways, to which the only drawback is the ice formed owing to the extreme nature of the climate. But though the extreme heat in summer and cold in winter must cause great inconvenience from mosquitoes on the one hand and solitude on the other, the climate is said to be healthy and the winter atmosphere to be bright, transparent, and exhilarating. Little is known of the mineral wealth, but undoubtedly coal, lignite, ironstone, and fireclay exist in large quantities.

The rivers and lakes flowing wholly or in part in the North-west Territory are as follows:—The Mackenzie (course 2400 miles), Coppermine, and Great Fish Rivers, flowing into the Arctic Ocean; the Nelson, Churchill, Albany, Severn, East Main, and Great Whale Rivers, flowing into the Hudson Bay; and the Saskatchewan, Assiniboine, and Red River, falling into Lake Winnipeg. The total river navigation within Dominion territory in the north-west is variously estimated at between 10,000 and 11,000 miles. Of this about 4000 are at present navigated. The chief lakes are Winnipeg, Manitoba, and Winnipegosis. Mossy Portage, 4 miles long, connects the head of Lake Winnipegosis with Cedar Lake on the main Saskatchewan, thus linking a line of continuous water communication 1500 miles in length, extending from Winnipeg city to the base of the Rocky Mountains. Besides these, which are perhaps the best known, there are the Great Slave, Great Bear, Athabasca, Clear Water, Reindeer, Nelson, Wollaston, Mistassine, and Abitibi, and innumerable smaller lakes. Winnipeg Lake is 300 miles long by from 50 to 60 miles wide, and is sometimes called the Black Sea of Canada.

The best known and most settled section of this immense region lies between Point du Chêne, 30 miles east of Winnipeg, and Lake St. Anne, 40 miles west of Fort Edmonton, forming the "fertile belt" of the north-west. It is 960 miles in length (east and west), with an average width of 250 miles. This would embrace 240,000 square miles. One-fourth of this area, equal to 40,000,000 acres, it is estimated, will produce wheat, barley, and potatoes of good quality and in great abundance. The best portion for stock-raising is said to be in the southerly and south-westerly parts of the Territories, embracing some 30,000,000 of acres, the natural home of the buffalo, and on the slopes and along the eastern base of the Rocky Mountain range, where the climate favours the "rauling" of the animals the entire winter with little, if any, shelter.

The Territories are, under the Dominion Act (38 Vict. cap. 49), governed by a lieutenant-governor, assisted by a council of five members, subject to instructions given by order in council at Ottawa or by the Canadian secretary of state. Representatives may be returned from time to time to a council or assembly according as districts of 1000 square miles attract a population of 1000 adults. By treaty of March, 1869, the Hudson Bay Territory passed, by purchase, to the Dominion of Canada; but the fur company continues its operations at the numerous forts or posts, which are depots for the skins collected in each district.

NORTH-WESTERN PROVINCES. The territories under the jurisdiction of the lieutenant-governor of the North-western Provinces, British India, lie between the parallels of 25° 51' and 31° 5' N. lat. and 77° 4' and 81° 43' E. lon. Inclusive of the territory of native feudatory states within the jurisdiction, estimated at 5125 square miles, they comprise a total area of 86,902 square miles. The population in 1881 was over 33,000,000, the great majority of whom were Hindus. These provinces are bounded on the N. by a part of the Punjab hill state of Bashahr, Chinese Tibet, Oudh (now included in the North-western Provinces), and Nepal; on the S. by the Chota Nagpore

division of Bengal, the Rewah State, the native states of Bundelkhand, and the Sauger division of the Central Provinces; on the E. by the Behar province of Bengal; and on the W. by the native states of Gwalior, Dholpur, and Bhurtpore of the Central India Agency, and the river Jumna up to its confluence with the Tons, beyond which point the latter stream forms the boundary separating the provinces from the native states of Simur and Jubbal in the Punjab jurisdiction.

The greater portion of this territory consists of an alluvial and gently inclined plain, dipping towards the south-east and open on that side. To the south-west this plain abuts upon the outlying spurs of the great elevated plateau of Central India. On the north-east lie the plains of Rohilkhand and Oudh; on the south-east the plains of the Benares division. To the south-west of the river Jumna lies the tract called Bundelkhand, which for a few miles from the banks of that river on the south, differs little from the comparatively level country on the north. Beyond this level country hills appear, at first isolated, then gradually assuming the formation of groups and ranges, finally merging in the Khairpur and Vindhya chains, covered with extensive forests and jungle, and traversed by streams that form torrents during the rainy season. Turning to the north we are met by a marshy belt of land known as the *Tarai*, and between this and the hills by a belt of waterless jungle, formed of boulders and the debris of the lower ranges of the Himalayas, and extending from 4 to 14 miles in width, called the *Bhabar*. To the west of the Bhabar come the Kotla, Patli, and Dehra duns or valleys. The largest of these duns, which all lie nearly parallel to the great chain of the Himalayas beyond, is the Dehra Dun, 48 miles long, the centre of which (2229 feet above the sea-level) divides the valley into two portions, with two distinct slopes of drainage to the east and west; the Asm and Suswa rivers emanate from this central elevation, the former flowing to the Jumna, the latter to the Ganges.

The Himalayan tracts included within these provinces consist of the districts of Kumaun and Garhwal, and native Garhwal or Tehri—the Kumaun division embracing all the ranges and valleys from the plains to Tibet—and of the tract known as *Jannsar Bawar*. The exterior ranges rise to a height of 7000 or 8000 feet, increasing gradually in parts, and in some places rising abruptly to this height. The elevation gradually increases again until 10,000 and 11,000 feet are attained in the spurs directly connected with the snowy range; we then meet the peaks of Trisul (22,342 feet), Nandi Debi (25,661 feet), Nandi Kot (22,538 feet), Badrinath and others, all situated to the south of the great central axis of the Himalayas. The Jannsar Bawar tract comprises similar hilly country lying between the upper courses of the Jumna and Tons rivers. These tracts form the great timber reserves of the North-western Provinces.

The principal river of these provinces is the Ganges, rising in the mountains of native Garhwal or Tehri, and flowing with a south-easterly course. On the right bank of this river, near Hardwar, the great Ganges Canal is drawn off. The next river in importance is the Jumna, also rising in native Garhwal to the west of the Ganges, and flowing for nearly two-thirds of its course in almost the same direction as the Ganges, finally meeting with it at Allahabad. The discharge of the Jumna as it enters the plains has been estimated at 4000 cubic feet per second in March, and that of the Ganges at Hardwar at 7000 cubic feet per second; at Benares the breadth of this last-named river during the winter season is 1400 feet, with an average depth of 35 feet, and a discharge of 19,000 cubic feet per second. During the rainy season the breadth at the same place is 3000 feet and the rise 43 feet. The other rivers flowing into the Ganges are

the Ranganga, rising in the Tarai, the Gumti, rising in the swamps of Rohilkhand, and the Gogra, called in its higher course the Kauriala. This last river vies with the Ganges itself in volume and the number of its tributary streams, while it surpasses the Ganges in velocity. On the right bank, the Jumna receives the large rivers that drain the eastern portions of the Rajputana, Central India, and Bundelkhand states, viz. the Chambal, the Betwa, and the Ken.

The canals of these provinces irrigate nearly 1,000,000 acres annually, and yield a revenue of nearly £225,000 sterling. The principal are the Ganges Canal, opened in 1851, consisting of 654 miles of main canal and 3078 miles of distributaries, and watering a tract of country in the Doab 320 miles in length and 60 miles in breadth; the Eastern Jumna Canal, opened in 1830, consisting of 130 miles of main canal and 625 miles of distributaries, and watering a tract 120 miles long and 15 miles broad; the Agra Canal, opened in 1871, 75 miles in length, irrigating about 400,000 acres; the Dehra Dun Canal, 67 miles in length, irrigating about 13,000 acres; and the canals in the Hamirpur and Jhansi districts, with a total length of 33 miles. Besides these there are other minor canals in Rohilkhand, opened at various times since 1874, for irrigating the belt of country along the Tarai, where much rice is raised.

The East Indian Railway (1280 miles in length) runs through the middle of these provinces up to the city of Delhi. From Allahabad a line to Jubbulpore (223 miles in length) connects the East Indian Railway with the Great Indian Peninsular Railway. The Oudh and Rohilkhand Railway (548 miles in length) joins the East Indian Railway at Benares, Cawnpore, and Aligarh. The Sind, Punjab, and Delhi Railway (554 miles in length) runs from Ghazialbad on the East Indian line, to Lahore and Multan in the Punjab, *via* Meerut, Saharanpur, and Unbulla. The State Railway from Agra *via* Bhurtpore joins the Rajputana State Railway, running from Delhi to Jey pore and Ajmere. The Sindhia State Railway (69 miles in length) runs from Agra to Gwalior *via* Dholpur. There are other light railways connected with important centres of the East Indian and Oudh and Rohilkhand lines, and the whole of the North-western Provinces are also well supplied with first-class metalled roads, the chief of which is the Grand Trunk Road, running through the principal towns of the Doab.

With the exception of the Tarai, the districts of these provinces are as a rule healthy. The climate is, however, subject to great extremes, the cold of winter being severe and the heat of summer almost intolerable. The hot westerly winds of April, May, and June are especially trying to European constitutions. The cold season commences with the close of the rains in October and lasts until April in the upper districts; in the Benares Division it may be considered to extend from November until the beginning of March. The hot weather succeeds and lasts until the beginning of the rains, which set in usually about the latter end of June and continue until the middle of October. The thermometer during the hot weather months ranges from 86° to 109° in the shade, the average being about 94°. The average yearly rainfall in the plains is from 30 to 45 inches, increasing gradually towards the hills, where Mussoorie receives 90 inches and Naini Tal 115 inches. The climate of the Benares division is more moist and cool, and partakes somewhat of the character of that of Bengal.

The principal crops grown and exported are cotton, opium, indigo, rice, barley, maize, sugar-cane, wheat, potatoes, oil-seeds, and the millets; tobacco, lac-dye, safflower, and saltpetre are also exported. Tea is largely grown in the Dehra Dun and Kumaun districts, and potatoes are extensively produced in several districts, having become one of the great food staples of the country. The North-western Provinces are not rich in minerals, but iron, lead,

and copper ores abound in Kumaun; *kankar*, an inferior kind of limestone, much used for roads and building purposes, is very abundant. The principal manufactures are sugar at Shahjahanpur, leather at Cawnpore, carpets and embroidery at Mirzapore, and *kinkhrahás* (gold brocades) at Benares. Brass and copper utensils for cooking purposes, cabinet-work and cutlery, are manufactured in every considerable town.

The lieutenant-governor is the chief executive authority in these provinces, which, for administrative purposes, is divided into seven divisions, embracing thirty-five districts; each division is under the superintendence of a commissioner, and each district under a magistrate-collector. The districts are again subdivided into *tahsils* or subdivisions, each under a native tahsildar or sub-collector. Certain districts are regulation while others are non-regulation. The regulation districts are those in which all the laws and regulations applicable to these provinces are in force; the non-regulation districts are those to which only certain portions of the law have been extended. They form the Kumaun and Jhansi divisions, also the Tarai. The chief executive officers of the non-regulation districts are styled deputy commissioners, having civil, criminal, and revenue powers. In the regulation districts, besides the magistrate-collector, there are three classes of civil judges, all subordinate to the high court at Allahabad, the seat of government.

With the death of Aurungzebe in 1707, began the rapid downfall of the Mogul power. The Marhatta reaction to the south, and the rise of the Sikh religion to the north-west, began to threaten the integrity of the Delhi empire, which received a severe shock in 1737 when Baji Rao marched to the gates of the capital, and a still more terrible reverse in the succeeding year, when Nadir Shah crossed the Indus, and, after defeating the emperor, plundered Delhi of a vast treasure, variously stated from £9,000,000 to £32,000,000 sterling. Within the North-western Provinces themselves, the process of disintegration had already begun. As early as 1671, during the lifetime of Aurungzebe, Chhatar Sal, a young Bundela chief, had headed an insurrection in his native hills, which continued intermittently throughout the next half century. [See BANDA DISTRICT.] After a desperate struggle, Chhatar Sal finally accepted, in 1732, the aid of the Peshwa Baji Rao, who was then slowly working his way up through Khandesh and Malwa to Hindustan. About two years later Chhatar Sal died, and bequeathed one-third of his dominions to the Peshwa, while the remainder was divided among his own descendants. In or about 1720, the Rohillas, a branch of the Yusufzai Afghans, made themselves similarly independent in the tract between the Ganges and the Himalayas now called Rohilkhand; and though they had often to struggle against the Delhi court, they maintained their freedom till they were conquered in 1774 by the Oudh Nawab, with the aid of British troops lent by Warren Hastings. About the same time, Sandat Ali Khan laid the foundations of the kingdom of Oudh, though he and his successor remained nominally subject to the emperor. Shortly afterwards, Baji Rao appeared upon the Jumna, and in 1736 sent his general to plunder the Doab, whence he was driven back by Sandat Ali. The final supremacy of the Marhattas after the retirement of Nadir Shah, and their establishment at Delhi in 1758, gave a show of unity to the empire for a while; but their defeat at Panipat by Ahmad Shah Durani in 1761 completed the dismemberment of the Mogul organization. During the remainder of the century, the state of the provinces was one of armed anarchy on every side, until the British stepped in for the restoration of order. The Nawab of Oudh and the Rohillas achieved complete independence beyond the Ganges; Bundelkhand remained divided between the Marhattas and the native chiefs; Sindhia slowly superseded the power of the Peshwa, and became gradually

supreme in Delhi; and the Doab was alternately overrun by the Bhartpur Jats, the Marhattas, the Rohillas, and every other of the contending parties, though remaining on the whole under the rule of the authorities at Delhi.

The British first came into connection with the North-western Provinces as they advanced along the valley of the Ganges from their foothold in Bengal. In 1763 the Nawab Wazir of Oudh, with the phantom Emperor Shah Alam, invaded Bengal. They received a crushing defeat at Baxar, and the emperor, with Balwant Singh, rajah of Benares, joined the British camp. By the subsequent agreement, Balwant Singh's estates were transferred from Oudh to the British; but the court of directors disapproved of the transfer, and a year later the territory was restored to Oudh, the Nawab guaranteeing to keep the Rajah in possession. In 1775, however, the new Nawab, Asaf-ud-daula, ceded Benares, Jaunpur, and Ghazipur to the British, retaining Allahabad and Korah, which had been taken from the emperor in the previous year, when the British sold them to Oudh. The Nawab Wazir had agreed in 1772 to pay a fixed sum for each brigade of English troops maintained for his aid, and in 1797 this subsidy amounted to £760,000 a year. Being always in arrears, the Nawab entered into negotiations for a cession of territory in lieu of subsidy; and in 1801 the treaty of Lucknow was signed, by which the whole of the Oudh dominions in the Doab, together with Rohilkhand, were made over to the British. As early as 1778 a British cantonment had been stationed at CAWNPORE, then in the midst of the Nawab's territory; and around it a great commercial city has slowly grown up. In 1801 the British dominions in the present North-western Provinces were thus confined to the Benares and Jaunpur tract, Rohilkhand, and the Lower Doab, including Allahabad and Cawnpore. Next year, however, the treaty of Bassein was signed with the Peshwa, by which he agreed to cede territory to the British of the value of twenty-six lakhs of rupees for the maintenance of an English contingent. By this treaty we obtained possession of Bundelkhand, not without the use of force. Sindhia, however, though nominally the vassal of the Peshwa, resisted the execution of the treaty; and it became necessary to take up arms against him, both in Hindustan and in the Deccan. Lord Lake's campaign in 1803 against Sindhia's French general, Perron, brought the whole remaining portion of the North-western Provinces under British rule. He took by storm Aligarh, Sindhia's great arsenal in the Doab. Thence he advanced upon Delhi, and within sight of the city defeated General Bourquin, another of Sindhia's partisan leaders, and three days later entered the Mogul capital in triumph. Reinstating the blind old emperor, Alam Shah, whom the Marhattas had long detained as a prisoner, he advanced upon Agra, which capitulated after a tedious siege. By the treaty of Sirji Anjanam, which followed these brilliant successes, Sindhia agreed to cede all his territories in the Doab, together with his fiefs on the western bank of the Jumna. The new districts thus acquired were at once amalgamated with those previously granted by the Nawab of Oudh, and formed into "the Ceded and Conquered" Provinces. The Himalayan districts of Kumaun and Garhwal were not acquired until after the Gurkha war of 1814-15; while the Delhi territory remained the personal appanage of the Mogul royal family, under the charge of a resident, until 1832, when it passed to the direct government of the East India Company.

For the first thirty years after the annexation, the North-western Provinces were administered by the same government as that of Bengal, a portion of the Bengal Board of Revenue being deputed to conduct the duties of that branch, generally at Allahabad, but sometimes on circuit elsewhere in the North-western Provinces. By the Act of Parliament (3 & 4 Will IV.), it was to be constituted into a

separate presidency, with a government; but a government had hardly been appointed in 1833 to Allahabad, when the law was suspended by another Act, which held the separation in abeyance, and sanctioned the appointment of a lieutenant-governor instead. Shortly afterwards, in 1835, the seat of government was transferred to Agra; but the "Sudder Board" and "Sudder Court" (chief revenue and judicial authorities) continued at Allahabad till 1844, when they too were located at Agra. During the mutiny (1857-58) Lord Canning assumed the government of the North-western Provinces at Allahabad, which has ever since formed the headquarters of the lieutenant-governor, and of all the chief offices of the government. Delhi, the historical metropolis of Northern India, was made over to the Punjab after the mutiny of 1857.

The first half-century of the British occupation was a period of peaceful progress. Trade and agriculture rapidly developed. Roads were pushed from end to end of the territory; the Eastern Jumna, Ganges, and Lower Ganges Canals were constructed for the irrigation of the Doab; the predatory chiefs of Bundelkhand and the Gurkhas were restrained; and the chief cities began once more to revive from the lethargy and decay of the eighteenth century. The Doab especially rose into a great agricultural and commercial tract, filled with new and growing cities, such as Cawnpore, Meerut, Aligarh, Rurki (Roorkee), and Saharanpur. This peaceful period was interrupted by the mutiny of 1857, which first broke out in the North-western Provinces, and produced more disastrous effects in this district than in any other part of India. After the repression of the rebellion, the principal event of importance in the Provinces has been the rapid development of the railway system, which is revolutionizing the commercial condition of the country and throwing open fresh outlets for the agricultural wealth of Rohilkhand and the Doab districts. The outlying Chief-commissionership of Oudh was placed under the administration of the lieutenant-governor of the North-western Provinces on the 17th January, 1877.

NORWAY, a country in Europe which comprehends the western portion of the Scandinavian peninsula, and extends from 58° to 71° N. lat., and between 5° and 31° E. lon. The coast-line of the whole peninsula, excluding inlets, is estimated at 3000 miles, to a total area of 122,780 square miles. Its length is about 1100 miles; its width varies from 20 to 280 miles. On the north and west it is washed by the Atlantic Ocean, and on the south by the North Sea and the Skager Rack. On the east is Sweden, and towards the north Russia.

Surface, Coasts, Rivers, &c.—By far the greatest part of the surface is covered with mountains, which form, especially in the south, a series of broad plateaus, separated occasionally by deep and narrow valleys. The most characteristic of these table-lands is the Dovrefeld, 3000 feet in elevation, which divides Norway into two great halves—called *Nordenfjelds* and *Südenfjelds*. The culminating point of the southern or broadest portion is 8500 feet above the sea, in lat. 61° 30' N. There are various other peaks throughout the country, ranging from 6200 to 8670 feet in height. Scarcely one-half of the surface is under 2050 feet absolute height, and about 3300 square miles of the mountain masses are always covered with snow.

The principal valleys are confined to the east side of the peninsula, but narrow belts between the coasts and the commencement of the plateaus are the only low lands in Norway; the most extensive of these surrounds the Gulf of Trondhjem. The western shores are indented by an immense number of gulfs or *fjords*, which occasionally extend deep into the table-lands. Bukke Fiord is wide at its entrance, and penetrates by two of its branches more than 50 miles inland. Hardanger Fiord is about 70 miles long. Søgne Fiord is narrow, and more than 80 miles long. A great number of narrow deep fjords lie between

Søgne Fiord and Trondhjem Fiord; and of bays further north, the largest and widest occur at the northern extremity. Christiania Fiord and Trondhjem Fiord are surrounded by fertile tracts. The other fjords are generally inclosed by high and barren rocks. The most extensive gulf on the south coast is that of Christiania. Some of the gulfs form excellent harbours; but the great number of mountainous islands and rocky islets which border the coast render access difficult. It has recently been discovered that the banks off the coast of Norway are of great breadth—reaching to 100 miles from the land. Beyond this limit the water is very cold; but on the banks it is comparatively warm, which accounts for the mild climate on the coast in winter. There are numerous lakes in the southern districts of Norway, on the eastern declivity of the mountains. They abound in fish, are very deep, but generally of small extent. Many of them are more than 2000 feet above the sea-level.

On the north the rivers are inconsiderable; owing to the mountains approaching so close to the shore; the chief of them are the Tana, 130 miles long, and the Alten, Mals, and Salten, which latter has a very violent current. The largest rivers are on the east side of the plateau, flowing south to the Skager Rack: these are, the Welsen; the Namsen, by which the northern coasts are supplied with timber (at its mouth, in the Namsen Fiord, is a jet of water, 130 feet in height); the Glommen, which receives the Wormen, the outlet of Lake Mjösen, and has a course of about 400 miles, interrupted by many cataracts; the Lougen, which is 60 miles long and from 1 to 5 miles wide, and flows into Lake Mjösen; and the Drammen, which flows into the Gulf of Christiania. The other rivers remarkable for the length of their course are—the Louven, the Skeen, and the Otter or Torridals, which run from 120 to 150 miles each, and fall into the Skager Rack. Ships enter the mouths of some of these rivers for 5 or 10 miles, but none of them are navigable for any distance on account of numerous *fos* (waterfalls). Of these, the Rjukanfoss, in the district of Telemarken, falls 513 feet, and the Vöringsfoss, in the district of Hardanger, has a perpendicular fall of 870 to 920 feet. The river systems of Norway are of the utmost importance to the country: the smaller streams are employed in driving the machinery of mines, corn and saw mills, and in floating timber to the larger rivers. The latter also serve as the chief means of communication in winter, when they are covered with strong ice.

Climate, Productions, &c.—The general temperature of Norway differs considerably in the various districts, but from its proximity to the sea, and the influence of the Gulf Stream, the climate is remarkably mild considering its latitude. The mean annual temperature ranges from 22° at North Cape, to 45° in lat. 60°. The snow-line is much higher than in corresponding countries: in 61° it is 5300 feet; and in lat. 70°, 3480 feet above the sea. Grain is cultivated up to the latter point in Norway, while in Siberia its cultivation ceases at 60°. The open sea never freezes, even at North Cape, but the shallow water of the Skager Rack is occasionally frozen in winter. In the east and the interior the cold is felt with the greatest intensity; here vast glaciers descend from the table-lands, and terrible avalanches occur from the melting of the snow. The year is nearly divided between winter and summer, spring being almost unknown, and the autumn cold and rigorous. Snow covers the ground from the beginning of November to the end of March; in January and February the thermometer is usually from 14° to 18°, and often as low as 2° Fahr. Summer lasts from May to September, during which the temperature is often as high as 108°. In the month of March the surface is strewed with ashes, earth, or sand, by which means the snow is melted, and from this process, combined with the great heat and the length

of the days, eight to twelve weeks are sometimes sufficient for sowing, ripening, and reaping the crops in the interior. The climate of the western coast, though milder than that of the south, or the inland districts, is deteriorated by excessive humidity and the exhalations from the sea, which injure vegetation. The winds and snow-storms are often exceedingly violent, and are generally preceded by thick fogs.

The vegetation of Norway varies according to climate and position. The forests of fir extend north to the polar circle, and those of pine beyond it. The birch attains the highest northern latitude (in 70° it grows at an elevation of 1580 feet above the sea), and from its sap the Norwegian makes a beverage resembling white wine. Apples, cherries, gooseberries, and plums are found as far as 64° N. lat., in the lower regions they are common and widely distributed; and even in the island of Tønderøe, 2½° from the polar circle, the mild influence of the sea is such that these fruits come to maturity. In the south the peach, apricot, and melon are largely cultivated; but flax, hemp, and hops are grown with most success. The principal grain is barley, the other cereals being cultivated only in favoured spots in the south. Oats are also successfully cultivated, and the potato has been extensively introduced. In the interior are small prairies, called *sæters*, principally used for pasturage. The rearing of cattle is the chief occupation of the population of the mountainous districts, who, like the Swiss, leave the villages and spend the summer with their flocks and herds in the higher regions. Cattle and goats are numerous; but sheep, which are of an inferior breed and yield coarse wool, are rare. Horned animals graze at liberty in the islands along the coast. The horses, small in size, but strong and hardy, are extensively exported to Sweden, England, and Scotland. In the north the reindeer is the chief support of the Laplander. The most destructive wild animals are the brown bear, wolf, fox, and lynx, which are hunted for their skins; but the increase of population has caused a diminution in their numbers. The elk is said to be increasing in numbers. The eagle preys upon sheep and lambs. Game of all kinds is abundant, and there are no game laws. Ermines, deer, and hares abound, and sea-fowl and eider-ducks are very plentiful. The procuring of the eider-down is perilous work, but very profitable, and there are very strict laws for the preservation of the eider-duck. The sea furnishes the principal means of subsistence to the inhabitants of the western coasts; cod, herrings, salmon, and lobsters being caught in large numbers. Whales are occasionally taken on the coast of Finnmark; there are extensive beds of oysters on all the shores, and the pearl oyster is found in many of the rivers.

The only mines in operation are those of silver, copper, iron, cobalt, chrome, manganese, and lead. The iron mines, which are the most numerous, are chiefly in the southern part of the country, on the Gulf of Christiania; the best is found in the district of Arendal, but the most productive at Kaafjord, near Hammerfest. The produce of the mines consists chiefly of magnetic ore, which renders it very superior for conversion into steel. The silver mine of Kongsberg is at present one of the richest in Europe. There are also some valuable copper mines, especially those at Rorås and in the environs of Trondhjem.

Constitution and Government.—In 1814 Norway was ceded by the King of Denmark, and annexed to Sweden by the allied powers, at the treaty of Kiel. It is still, however, a "free, independent, and indivisible state," united only under the same sovereign with Sweden.

The constitution, called the Grundlov, bears date 4th November, 1814, with several modifications passed at various times up to 1884. It vests the legislative power of the realm in the Storting, or Great Court, the representative of the sovereign people. The king has the

command of the land and sea forces, and makes all appointments, but, except in a few cases, is not allowed to nominate any but Norwegians to public offices under the crown. The king possesses the right of veto over laws passed by the Storting, but, except in constitutional matters, only for a limited period. The royal veto may be exercised twice; but if the same bill pass three Stornings formed by separate and subsequent elections, it becomes the law of the land without the assent of the sovereign.

The Storting formerly assembled every three years; but by a modification of the electoral law, adopted in April, 1869, it was resolved to hold annual sittings. Every citizen who in the last year before the election has paid income tax, of at least 500 kroner in the country and 800 in the towns, provided he is qualified by one year's residence and is not a servant, is entitled to vote; and under the same conditions, if thirty years of age, to be elected. The whole country is divided into electoral districts, according to population, which are again parcelled out into subdivisions according to area. The mode of election is indirect, the people first nominating a number of deputies, to whom devolves the task of appointing the representatives in the Storting.

The Storting, when elected, divides itself into two houses, the Lagthing and the Odelsting. The former is composed of one-fourth of the members of the Storting, and the other of the remaining three-fourths. All new bills and propositions must originate in the Odelsting, from which they pass into the Lagthing, to be either accepted or rejected. In the latter case, should the Odelsting demand it, the two Houses assemble in common sitting to deliberate on the measure, and the final decision is given by a majority of two thirds of the voters. While in session, every member of the Storting has an allowance, besides travelling expenses. The executive is represented by the king, who exercises his authority through a council of state, composed of two ministers of state and eight councillors. Two of the councillors, who change every year, together with one of the ministers, form a delegation of the council of state, residing at Stockholm, near the king. Ministers and councillors of state are, since July 1884, entitled to be present in the Storting and to take part in the discussions, when public, but without a vote.

Revenue and Expenditure.—The financial estimates voted by the Storting are for one year. The amount voted for 1884–85 was 42,385,841 crowns, equal to about £2,334,022. Customs and excise produce nearly the whole income.

At the separation of Norway from Denmark, the financial affairs of the kingdom were in a most disordered state. Gold and silver had completely disappeared from circulation, and their place had been taken by more than £30,000,000 of paper money, issued by the former government with a forced course. Matters have since been much improved in this respect, and the greater part of the public debt is gradually being extinguished by means of a sinking fund. The amount owing in 1886 was £6,000,000.

Nearly half the debt was incurred in order to construct railways, and a considerable part of the money obtained by these loans was lent by the state in advances made to promote public works and for other similar purposes, generally on the security of the works or property for whose benefit the advances were made.

Army and Navy.—The troops of the kingdom are raised mainly by conscription, and to a small extent by enlistment. By the terms of two laws voted by the Storting in 1866 and 1876, the land forces are divided into the troops of the line, the military train, the Landvaern or militia, the civic guards, and in time of war the Landstorm, or final levy. All young men past the twenty-first year of age are liable to the conscription. They have but

to go through a first training in the school of recruits, extending over from fifty to ninety days, and are then sent on furlough, with obligation to meet for annual practice. The nominal term of service is ten years—seven in the line and three in the *Landvaern* or militia. The number of troops under arms can never exceed, even in war, 18,000 men, without consent of the Storting. In 1884 the army numbered 40,000 men, with 800 officers. The king has permission to keep a guard of Norwegian volunteers; and to transfer, for the purpose of common military exercises, 3000 men annually from Norway to Sweden, and *vice versa*. Otherwise, it is not allowed to any Norwegian soldier to set foot in the sister kingdom.

According to the latest official returns the naval force of Norway comprises forty steamers of various sizes, carrying 150 guns. In order to utilize as much as possible the vessels of the navy for peaceful as well as warlike purposes, most of them are attached to the postal service.

Population, Religion, Education, Trade, &c.—The kingdom is divided into the twenty provinces, or *Amts*, of Christiania (town), Akershuus, Smaalenens, Hedemarken, Christiania, Buskerud, Jarlsberg, Bradsberg, Nedenæs, Lister and Mandal, Stavanger, South Bergenhuus, North Bergenhuus, Bergen (town), Romsdal, South Trondhjem, North Trondhjem, Nordland, Tromsø, Finmark. The population in 1881 was 1,913,000.

The Norwegians, like the Danes and Swedes, are of Teutonic origin, and speak a language which differs very little from the Swedish. In the most northern districts there are many families of Finlanders and Laplanders. The genuine Norwegians are of middle height, with strong, well-knit, muscular frames, of fair skin, with light flaxen or yellow hair, and blue eyes. They are frank, yet cautious and reserved, honest, moderate, and religious, and have an intense love for their country. Labour and frugality are the characteristic traits of the people. Want of cleanliness, and a liking for strong drink, are their most obvious failings. Generally speaking, however, the *fêtes* of Midsummer and Christmas are the only occasions on which the Norwegian deviates from his simple habits. The peasants live in wooden huts, covered with birch bark and turf; they have no villages, but each proprietor lives on his own farm, however small. There are only about 13,000 Finns or Laps altogether, who are of the Mongolian race, and live on the products of their reindeer. The inhabitants of Finmark lead a very miserable life; they have but little grain, and when that fails they make cakes of bark from the young pine trees; also moss-bread, which is a much more wholesome food than the former. The whole of the inhabitants of the kingdom are members of the Lutheran Church, with the exception of a few dissenters. The clergy are paid by means of rents from glebe lands, a small tithe of corn from each farm, or of fish in some parts, fees, and other unfixed sources of revenue. In the remote country districts the minister exercises great authority, and is often called on to settle disputes and assume judicial functions. As a class they are virtuous and enlightened, interested and often occupying themselves in everything that concerns public usefulness and the prosperity of the country. Those professing the Lutheran doctrines are obliged to train their children in the same religion; hence the scarcity of dissenters. All sects of Christians, Jesuits excepted, and Jews are tolerated, but only members of the Lutheran Church are admitted to public offices and charges under the government. Every individual of the age of twenty not confirmed is liable to be sent to the house of correction to receive the necessary instruction. The law forbids the marriage of any one who cannot procure a certificate of confirmation. Each commune is bound to support its own poor, and mendicity is punished as a crime.

Education is compulsory. Every peasant can read and

write. Instruction in the primary schools is limited to reading, writing, arithmetic, and singing, with sometimes the rudiments of grammar and geography. Almost every town supports a superior school; many have Sabbath and private schools; and in most of the principal towns is a "*lærde skole*," or college, the instruction in which includes theology, Latin, Greek, Norwegian, German, French, English, mathematics, history, and geography. Christiania has a university, founded by the Danish government in 1811, which is modelled on the system of the German universities. There are excellent public libraries, museums, and scientific collections in the different towns. The freedom of the press is guaranteed, but the principal literary productions are periodical.

Norway is essentially an agricultural and pastoral country. Of the total male population two-thirds are connected with agriculture, either as proprietors, farmers, or farm-servants; but only about the hundredth part of the entire surface is under culture, and there is a decided tendency to congregate in towns.

In order to improve agricultural knowledge in general, and to form teachers for that purpose, the state has established a central institution where theoretical and practical instruction is given; besides this there are in the different provinces of the country several lesser institutions, supported partly by the state and partly by the province itself. The use of these institutions becomes more and more acknowledged, and the results thereof are shown by the increase in the production. No law of primogeniture exists. Labourers and trades unions abound, but they are strictly friendly or benefit societies. The labouring population are in general well housed, and their condition appears to contrast favourably with the same class in other European nations. Co-operative societies for building, trading, &c., are found all over the country; and there are also soup kitchens, libraries, washing and bathing establishments—all on the mutual support system, and in a prosperous condition.

Norway is naturally formed for a manufacturing country. Its universal water-power, abundant fuel, and deep inlets, give it easy means for the supply and conversion of raw material, while a long annual period of inaction as regards outdoor labour seems to make indoor occupation a necessary resource. Owing, however, to the difficulty of transport, all the seats of industry, and the only towns, are on the coast, and chiefly on the Gulf of Christiania. Although the manufactures in the country are not yet very extensive, still in the course of the last twenty years several have been established, especially at and in the neighbourhood of Christiania, consisting of spinning and weaving mills, cloth manufactories, and considerable manufactures of sailcloth. Besides these there are mechanical manufactures in Christiania, Bergen, and Trondhjem. Extensive brandy distilleries and saw-mills employ large numbers of the population; next in importance to these are forges and metal foundries, the produce of which is exported in a raw state, except what is used in the manufacture of arms at Kongsberg, and for making iron wire and nails. The other manufactures comprise glass, paper, oil, gunpowder, soap, tobacco, sugar-refining, and the preparation of skins and leather. Shipbuilding is actively prosecuted in the ports.

The great wealth of Norway, however, consists in her forests and fisheries. The principal forests are in the interior; and the timber is felled in the autumn and winter, being conveyed over the snow to the coast. It is estimated that at least four-fifths of the surface is covered with wood—consisting principally of beech, oak, maple, spruce fir, Scotch fir, aspen, and birch. The most valuable of these for commercial purposes are the Scotch and spruce firs, the timber of which is largely exported. Scarcely inferior in importance to the commerce in wood

are the fisheries, which afford the second staple commodity of export, and at the same time give employment to the bulk of the population from the Naaze to the Warangerfiord, at the entrance of the White Sea. The fisheries are divided into the herring fishery, which usually commences soon after the new year; the winter cod fishery, which generally commences towards the end of December; and the spring and summer fishery along the coast of Finnmark to the White Sea. The herring fishery continues for about three months. It is confined almost exclusively to the district between the Naaze and the headland of Stat, a distance of about 300 miles. The fish are generally caught in nets, salted, and then packed in barrels for exportation. The cod fishery commences about the end of December, around and between the Lofoden Islands, and continues to the middle of April. Nearly 6000 boats and 25,000 men assemble at the central point of these islands every year for the great fishing expedition.

The export of ice is important, and the Norwegian ice appears to have replaced the "Wenlum Lake" to a great extent in the English market. Cargoes are shipped to Egypt, Spain, and Italy, but England is the chief market. There is regular steam communication between London, Hull, and Leith, and Christiansand, Christiania, and Bergen.

About three fourths of the imports from Norway into the United Kingdom consist of wood and timber; the most notable of the other articles are fish, ice, and quantities of pyrites, bar iron, and copper ore. Coals, cotton manufactures, woollen manufactures, and wrought and unwrought iron, form the staple articles of British export to Norway, but large quantities of foreign and colonial produce and manufactures, principally raw cotton, hides, sugar, and wool, are also exported.

The foreign trade of Norway was at one time more extensive than at present. Bergen and Trondhjem were members of the Hanseatic Association, and on its decline retained many of their old privileges. Christiania has of late years, however, entirely distanced these cities in material wealth and population, and now absorbs one-half the total imports of the country.

In no country are the conditions so favourable for the development of seamen as in Norway; the extensive range of sea-coast, with open harbours and the valuable fisheries all the year round, habituate the youthful part of the population to the dangers of the sea; and considering its population, Norway has the largest commercial navy in the world.

Commerce in the interior of the country is greatly impeded for want of means of transit, none of the rivers being navigable, except near their mouths. The usual communication is by sea, and regular services have successively been established between the principal towns of the coast, from Christiania to Hammerfest. On the southern coasts are several railways, and some good roads connecting the towns; but they pass over hill and valley at extraordinary inequalities of level. Of late years Norway has become very popular as a pleasant summer resort for tourists. The country is well provided with telegraphic communication. Around the numerous islands on the western coast there are violent and irregular currents, which render the navigation dangerous. Among these is the celebrated *Maelstrom*, or Moskenstrom, the danger from which has, however, been greatly exaggerated.

CHRISTIANIA is the capital of Norway. The other principal towns are BERGEN, CHRISTIANSAND, and DRONTHEIM or Trondhjem.

Norway, History of.—The history of Norway is for the most part bound up with that of either Sweden or Denmark, or both. United fast between an inhospitable coast and mountainous traversable with difficulty, with a larger and far more powerful nation beyond those mountains, Norway has not often had much chance of extension or of independ-

nec. But in the earliest times it was not so. Then the very nature of the coast incited the people to deeds of bravery, and the most daring seamen and explorers came from Norwegian shores. The Roman accounts mixed up Norwegians with Swedes and Danes, and the English fell much into the same error. But there is now little doubt that the "Danes" who first appeared off our coast in 787 were really men of Norway, and Norsemen were also among the early conquerors of Normandy. Afterwards, while the men of Denmark poured host after host upon the shores of England, France, and the Netherlands, the Norwegians went further afield. From Northumbria northwards, and as far as the Shetlands and Orkneys, they harried our coasts and islands, and then descending by the Hebrides they founded a small Norse kingdom of Dublin in Ireland. During the ninth century these settlements were consolidated into actual colonies, and the close of that century (874) saw the beginning of the colonization of Iceland. (The island was discovered by Norse sailors in 860.) Greenland was discovered in 876, and colonized from Iceland in 983, and the shores of America were trodden by Norwegian feet first among Europeans, in 1001, and the adventurous Norsemen gave it the name of "Vineland." An attempt to colonize it seems to have failed. The fame of these daring Vikings was spread from the arctic regions to the shores of Asia Minor, and they and their kinsmen of Scandinavia ruled on the thrones not only of Norway, Denmark, and Sweden, but of England, of Normandy, of Naples, and of Russia; and that, too, by force of arms.

All Norway was at the beginning of the ninth century cut up into small districts (*fylki*) or counties, each ruled by its king and his jarls, all important business being referred to the public assembly or Thing. The land was held by individuals at the earliest historical date: the Teutonic custom of common-land, or folk-land, held by the mark, seems quite unknown. The first rulers to weld the nation into a whole were some kings of Swedish descent in the south, near the present Christiania, who began to extend their borders at the expense of their neighbours. In 860 Harald Haarfager (the Fair-haired), as a boy of ten, succeeded to this newly-founded throne, and almost at once showed immense power as a sovereign. While yet a mere boy he subdued the whole of Norway to the north of the Sogne Fiord, and by middle age he accomplished the entire conquest (872). He overthrew the old constitution to a very large extent, creating landsmen (*leudemenn*), who, in return for holding lands by his favour, supplied him with forces for war. The stubborn Norsemen long resisted, and many left the country for Scotland, Iceland, &c. As they from time to time gave King Harald trouble by making armed descents upon Norway, he eventually made a great expedition to the Scottish islands, and pushed as far south as the Isle of Man, bringing all the Norse colonies into order and obedience, and appointing jarls over them.

In 933 King Harald the Fair-haired died, leaving the kingdom to his son Erik Blodaxe (Blood-axe); but it was Hakon, a younger brother, who succeeded, a prince who had been brought up at our English Athelstan's court as a Christian, and who, though firm, was well disposed to mitigate the severities of his father. He failed to impose Christianity upon his people, however. Erik Blodaxe fled to the Orkneys; afterwards he was for some time King of Northumbria, when he died 952. His sons made many attacks upon their uncle, King Hakon, and at last in 961 they were successful, and slew him in an ambush. The country again split up, much of it being under Earl Hakon, called the Great, and the sons of Erik were resisted on every side. Eventually they were expelled, and the country restored to something like order by Earl Hakon. The "great earl" though he never took the title of king, held all the actual power of the country. In 995 Earl Hakon was slain in a

mutiny, and in the same year Olaf, son of Tryggve, a great-grandson of King Harald, landed in Norway from Ireland. Olaf figures in our English history as fighting in the battle of Maldon 991. Olaf was proclaimed king, and reigned till 1001; he had the distinguished honour of bringing his country to the Christian faith. His splendid courage and handsome form made him the darling of his people, and his death in a sea-fight is one of the favourite ballad-subjects in the north. The son of Earl Hakon with a fleet of Swedish and Danish ships attacked him treacherously, cut him off with only a few ships from the rest of the fleet, and then butchered the whole of the crews thus captured. Olaf and his men resisted to the last, and when only the king was left alive he leaped, in full armour as he was, into the sea. The victorious curl and the two kings, his patrons, divided out the country between them. Norway was restored to the rule of the original race by Olaf (called afterwards St. Olaf), a descendant of Harald Haarfager, who arrived from exile in 1015, and soon acquired the supreme power. Olaf Tryggveson had by force turned Norway Christian; St. Olaf made the Christianity a reality, besides yielding the government of the country for the first time into one whole. In 1028 Cnut the Great, king of Denmark and of England, conquered Norway also, and St. Olaf fled to Russia. He was slain in an attempt to regain his crown in 1030. The Danish rule after Cnut proved unpopular, and Olaf's memory was bitterly regretted. His son Magnus was therefore invited to return, and by an arrangement with the Danish king, Harthacnut, succeeded the latter at his death. Harald Hardrada, i.e. "hard-counsel" (English, *hard rede*), or as some say, *haartraða*, "double beard," the half-brother of Magnus' father, who had earned a brilliant reputation and immense riches by campaigning as the head of the famous Greek Imperial Varanger (Væringjar) Guards in the East, compelled Magnus to share the throne with him. He fell at Stamford Bridge in England, in 1066, when engaged in an expedition to aid Earl Tostig against his brother Harold, king of England.

Under Harald's son, Olaf the Quiet, a peace followed this stormy reign; but in 1093 Magnus, son of Olaf (Magnus the Barefoot), renewed the attempts at foreign conquests of his grandfather, and like him fell in battle (in Ireland) in 1103. His sons reigned in common, and one of them, Sigurd, made a crusade to Jerusalem single-handed, with only his brave Norwegians. At Sigurd's death, in 1130, the long dynasty of Harald Haarfager closed. Illegitimate descendants of the royal family and pretenders struggled for the crown amid infinite disorder. A Feroe islander, Sverro by name, a mere freebooter, acquired the crown in 1184 by help of his free lances (Birkebeinar), and ruled wisely and well, though incessantly fighting for his crown against the church and the aristocracy. Under his grandson, Hakon (1217-63), the troubled land gradually grew to peace. This is the king who was defeated and killed at Largs in Scotland, and who on the other hand acquired Uelca as a Norwegian possession. Under Hakon's son, Magnus, Norway lost her time-honoured possession of the Hebrides, which now fell to Scotland. Margaret, granddaughter of King Magnus, united Norway with Sweden, and also with Denmark, under her rule (1389); and the union of Calmar (1397) consolidated the three states into one united kingdom. Sweden and Norway separated again from Denmark in 1448, and were reunited in 1450. Norway and Denmark separated from Sweden in 1523, but Norway was given to Sweden once more by the treaty of Kiel in 1814. After a short war of independence Charles XIII. of Sweden was accepted by the Norwegians as their king, 4th November, 1814; and since then the crowns, though not the kingdoms, have been united. Norway has always been intensely democratic and jealously independent. The power of the kings rested nearly throughout upon the people themselves. There

were, however, still nobles; but nobility was now formally abolished (1821).

The millennium of the kingdom (dated from the crowning victory of Harald Haarfager at Hlafsford in 872) was celebrated with great rejoicings in 1872. From 1881 onwards attempts at extending the crown prerogatives kept the country in angry jealousy for its threatened independence, and an outbreak many times seemed imminent. On 22nd October, 1883, the supreme council even went so far as to impeach the whole of the ministers for treasonable advice to the king, and on 27th February, 1884, the prime minister (Selmers) was found guilty, dismissed from the public service, and saddled with the costs of the prosecution. Convictions of the other ministers followed. The king acceded to the dismissal, but wished to reserve much of the rights (the power of veto, &c.) which the ministers had claimed in his name. He was, however, ultimately compelled to yield to the popular demands.

Language.—The Norwegian language, or Norse (*Norsk* in the native tongue), is the chief member of the Scandinavian family of the Teutonic languages. It is preserved in the archaic form of Old Norse in Iceland, where an early Norse colonization implanted it, and where it has remained isolated to a very large extent, and so kept pure. The oldest of the Eddas, or national myth-scriptures, go back in this Old Norse to the twelfth century, and represent by far the oldest monument of Teutonic speech.

The literature of Norway proper is fairly extensive, but chiefly modern, and much based upon Danish models owing to the long connection with Denmark. The establishment of the University of Christiania, in 1811, gave a fresh impetus to native writers, and a steadily growing national sentiment has been the result. The poet and dramatist Wergeland (1808-45) may be regarded as the creator of original Norwegian literature.

NORWICH (pronounced *Nor'ridge*), a municipal borough, and a city and county of itself, is the capital of the county of Norfolk. It is 114 miles north-east from London by the Great Eastern Railway. It communicates with Yarmouth, 20 miles west, by means of the same line. The Ipswich and Norwich Railway connects it with various important towns.

Norwich appears to have risen gradually from the decay of Caistor or Castor St. Edmunds, now an inconsiderable village, about 3 miles south from Norwich, but anciently a Roman town, named *Venta Icenorum*. In the time of Edward the Confessor, Norwich, with its twenty-five churches, 1320 burgesses, and considerable labouring population, had become the foremost borough in the country. William the Conqueror bestowed the castle on Roger Bigod, one of his Norman followers, who probably erected the present keep. It continued in the possession of his descendants till the reign of King John, when it was seized by the king and finally surrendered to the crown in 1224. In 1137 happened the alleged murder by Jews of a boy, afterwards canonized as "St. William," for which many of that persecuted race were murdered. In the reign of Henry I. a colony of Flemings came over, who were joined by a still greater number of immigrants in 1336, from which time Norwich became an important seat of manufactures. In 1403 Henry IV. separated the city from the county, and made it a county of itself with peculiar privileges. Its prosperity, however, owing to plague, scarcity, and frequent fires, had begun to decline, when, in 1566, a fresh immigration took place of 4000 Flemings, who had fled from the persecutions of the Duke of Alva. In the civil wars of Charles I. Norwich declared for the Parliament. It is remarkable in ecclesiastical history for its numerous convents and other religious establishments, the funds of which have in most cases been converted to charitable uses, and placed in the trust of the corporation.

The county of the city of Norwich extends about 4 miles from north to south, and as many from east to west. The town itself is not exactly in the centre of this district, but rather to the north-east; and extends about a mile and a half in length from north-west to south-east, and from three-quarters of a mile to a mile in breadth, but it stands on a considerable space of ground for its population, the houses being much intermixed with gardens, so that it has been designated "a city in an orchard." It is of irregular form, and very irregularly laid out. The streets are narrow and winding; some of them follow the line of the walls which formerly surrounded the city. The market-place is one of the most spacious in England. The modern parts are well built. The river Wensum enters Norwich on the north-west side, and winds partly through, partly round the town, until it finally leaves it on the south-east side; it is crossed by at least ten bridges in the town or close to it. In the time of the Saxons this river must have been a great tidal estuary as far as Norwich, for even in the thirteenth and fourteenth centuries the city is spoken of as situated on an arm of the sea.

The most interesting of the public buildings are the Castle, erected by the Normans, and the cathedral. The

inner ditch of the castle, and the bridge over it, 150 feet long, and with a fine Norman arch across the moat, still remain. The entrance tower, of richly-ornamented Norman architecture, known as Bigod's Tower, has been restored. The eastern front has also been renovated. The quadrangular keep is used as a prison.

The foundation of the Cathedral was laid in 1094 by Herbert Losinga, the bishop in whose time the see was removed from Thetford to Norwich; but he finished only the choir and tower: succeeding prelates added the other parts of the building. The entire length of the cathedral from east to west is 411 feet; the breadth at the transepts, 191 feet; the breadth of the nave and side aisles, 71 feet. The height of the tower and spire is 315 feet. The building is almost wholly Norman, and has been improved and renovated in modern times.

The parish churches of Norwich are very numerous. Some of them are valuable specimens of ancient architecture. Those of St. Benedict, St. Ethelred, and St. Julian have round towers, usually considered to be of early Norman date. The most conspicuous is that of St. Peter Mancroft, a large and fine Perpendicular structure, with a lofty tower and handsome windows. It was restored in



City of Norwich.

a very thorough manner in 1864, and has a grand peal of twelve bells. There are some other buildings which had anciently an ecclesiastical character. St. Andrew's Hall, a conventual building dating from the fifteenth century, is a fine edifice, where the Norwich musical festivals are held. Numerous places of worship for dissenters are supported.

The Guildhall is a large old building, erected in the fifteenth or sixteenth century, and since repaired or altered. The Shire-hall, in the castle ditch, is a brick building in the Tudor style, cased with cement. The charitable institutions and schools are very numerous. The public library contains 50,000 volumes. The Free Grammar-school was originally a chancel house, founded about 1315 by Bishop Salmon. There is a fine hospital.

Two centuries ago Norwich ranked as the first English manufacturing town and the third English city. "It was the chief seat of the chief manufacture of the realm," says Macaulay. "No place in the kingdom, except the capital and the universities, had more attractions for the curious." It had "a court in miniature. In the heart of the city stood an old palace of the dukes of Norfolk, said to have been the largest town house in the kingdom out of London." The application of steam to machinery was a means of diverting from Norwich the greater portion of her trade in the manufacture of textile fabrics. Situated at a considerable distance from the coal-fields, her manufacturers were prevented from obtaining the new motive power at a sufficiently cheap rate to be able to compete successfully with the northern millowners. Efforts were made to retain the

old industries by erecting factories fitted with improved machinery; but workmen's strikes, and the cost of the carriage of coal and of the transport of goods, led many manufacturers to give up the struggle and to take their capital to rising towns, where they could carry on their businesses under more advantageous circumstances. Notwithstanding these migrations Norwich has retained a portion of its ancient trade. Its crapes are famous, and its shawls are in great request. Just at the time Norwich was losing much of its trade in the manufacture of materials for clothes a citizen, who had probably some conception of the law of averages, but upon the plan of offering ready-made boots and shoes of different sizes for sale. The idea was taken up by two or three more enterprising men, who made up large quantities of material into boots and shoes and disposed of them in other parts of the country. Thus Norwich originated the wholesale ready-made boot and shoe trade, which now gives employment to 6000 or 7000 of its population. Of late years the ready-made clothing business has been largely developed. The most remarkable of the industries of Norwich is the manufacture of Colman's mustard. The manufacture of agricultural implements is another important industry, and the town is famous for the perfection of its art castings. The corn-market is held in a large handsome building, the Corn Exchange, erected for the purpose, and the cattle-market is in an open area adjacent to the castle. Trade in agricultural produce, coals, and other heavy goods is carried on by means of the river, chiefly in lighters of from 15 to 20 tons burden. To facilitate the approach of sea-borne vessels, to which the harbour has been made to some extent accessible, an entrance has been made from the sea into the navigable channel of the Waveney, by Lake Lothing, and a ship canal, for vessels drawing 10 feet, from the Waveney to the Yare.

The municipal borough is divided into eight wards, and is governed by sixteen aldermen and forty-eight councillors. The population of the parliamentary borough, which returns two members, was 87,843 in 1881.

NORWICH or MAMMALIFEROUS CRAG, the newest division of the English PLEISTOCENE deposits. It is quite a local accumulation, scarcely attaining a thickness of 20 feet, and most typically developed in the immediate vicinity of Norwich. As it everywhere rests upon the eroded surface of the chalk its stratigraphical relations to the coalline and red crags are inferred merely from the evidence of contained fossils, and the term *mammaliferous* was first applied to these beds by Mr. Charlesworth, before either of the other divisions was known to yield mammalian remains. About 93 per cent. of the fossil mollusca found in the Norwich crag still exist at the present day, and the fact that many of these indicate estuarine conditions, while a considerable percentage are common to the red crag, has induced Professor Prestwich to consider the formation as contemporaneous with the latter, this being deposited in a more exclusively marine area.

NOSE, one of the external apertures of the respiratory system, and the organ for the sense of smell. The portion of the nose by which odours are perceived lies deep back in the cavity to which the external apertures of the nostrils lead; the portion which is prominent upon the face serves merely as the apparatus for inhaling the air which is impregnated with odour.

This external nose is composed of five cartilages, two resting on the nasal bones, somewhat triangular in shape and flat, two wings curving outwards and bounding the nostrils, all these uniting together to form the lobe or tip of the nose; and finally, a central septum, triangular and flat, and continuous with the bony system of the inner nose alone. These fibro-cartilages are well shown in the Plate. Fig. 1 shows the fibro-cartilages and the bones of the outer nose in profile: *a*, the eyebrow; *b*, one of the

nasal bones; *c*, nasal process of the superior maxillary bone; *d*, cartilage of the septum; *e*, one of the lateral cartilages; *f*, one of the alar or nostril cartilages; *g*, the small accessory sesamoid cartilages; *h*, aperture of the nostril. Fig. 2 shows the same parts in front view, the lettering being the same as in fig. 1. The nostrils are furnished with strong hairs, which act protectively, keeping out harmful substances, and also filling somewhat the function of a respirator, and warding off a rush of too cold air; they serve further to retain the mucus, which is a necessary factor in the operation of smelling.

In the elephant the external nose is elongated in the form of the well-known trunk or proboscis, and becomes a prehensile organ of great value, made up of abnormal developments of the nasal and labial muscles. The two nostrils may be continued forwards by a single passage opening by a single orifice, as in porpoises. There are two posterior nares in man opening into the throat, just as there are two anterior nares opening into the external nose; but in fishes both the posterior and anterior nares open upon the external surface, the organ still remaining double, as nearly always is the case. But single chambered noses exist (marsipobranchs), ending in a blind termination (Jauprey), or opening into the throat (myxine). The posterior nares generally open into the pharynx or upward prolongation of the throat, but there are exceptions, as in the ant-eater, *Myrmecophaga*, when they open half-way down the throat.

The muscles moving the human nose (fig. 3) are: *f*, the *compressor naris*; *h*, the little compressor; *g*, the *pyramidalis*, which by pulling on the root of the nose, *a*, raises the skin vertically up along the bridge of the nose; *i* and *l*, the two *levatori ala nasi*, which distend the nostril; *c*, the *nasolabialis*, which unites the nose with *d*, the great *orbicularis* of the mouth; *e d**, the labial and nasal portions of the *levator labii superioris alaque nasi*, which may be called the sneering muscle, raising the nostril and outer corner of the lip and uncovering the canine tooth. In fig. 8 the connection with the great muscles of the eyebrow (*a*), eye (*b*), and mouth (*c*) is shown in another point of view.

The muscles of the nose and surrounding regions are wonderfully expressive. Yet they are found well developed in the inexpressive face of the great ant-eater, probably an example of "degeneracy." In such faces as that of the crocodile they are all aborted; but in many animals, as the pig, for instance, they serve largely to indicate feeling. The pig has extra nasal muscles to move the snout; one pair rises from the zygoma and maxillary bones and raises the snout as a whole, and another pair, inserted at one end into the zygoma and at the other into the median septum, depress the snout. In the mole there are even four snout muscles on each side, all arising above the eye and ending in the tip of the nose. It is evident that its power of smell is very acute and very valuable to this animal, involving rapid movements of the nose. Touch and smell have to make up for the uselessness of eyes in the darkness of underground life. The mole has also an extra median ossicle further to complicate his nose. The wonderful nose muscles of the elephant have been spoken of, but of course extra muscles are required to move this great trunk itself, and these are in three pairs, one pair to elevate, one to depress, and one to move it sideways.

The ordinary nerves of the outer nose, that is, the nerves of common sensation, and the motor nerves of the muscles are shown in fig. 8, where *h l k* is the supra-trochlear nerve (fifth), *g* supra-orbital nerve, *e d* nasal nerve, *i* infra-orbital nerve (fifth), *m* facial nerve. The nerve of ordinary sensation for the interior of the nose is the nasal branch of the ophthalmic division of the fifth pair, descending, like the olfactory nerves, through the cribriform plate at *s* (fig. 7), and yielding the feelings of heat and cold, tickling pain, tension, &c. The sphenopalatal ganglion is shown at *n*,

sending branches, *op*, to the superior and inferior turbinate bones respectively; passing onwards to *r* it ramifies over the palate. The special nerves of the nose, those which are competent to perceive the stimulus of odours and cause the sensation of smell, arise from the pair of olfactory lobes, rising from the olfactory ganglia of the brain, and passing forward to where they lie above the ethmoid bone in a pair of peduncles, one for each side of the nose. An olfactory peduncle is shown at *a*, its termination broadens to a bulb as at *b*, thence pass down numerous filaments which are the real olfactory nerves, for the lobes are actual portions of the brain itself, through the cribriform (sieve-like) plate of the ethmoid *d* into the nose, where they ramify both externally on the turbinated bones and internally on the bony septum, lying between the periosteum and the pituitary membrane. At the termination of the olfactory filaments we find rod-like olfactory cells, just as we find rods and cones in the retina, and the sensation is believed to be generated in these rod like cells; but we know no more how this occurs than we do in the similar cases of the eye or the ear.

The inner nose, or nasal cavity, rises in man to a height level with the external depression at the root of the nose. It presents by its walls an extended surface covered throughout its upper part by a delicate and very vascular mucous membrane, and is in communication with several sinuses, also invested by the same membrane. The bones which build it up are fourteen, four single bones and five pairs. A central bony partition, *d*, fig. 4, divides the cavity in two in a line with *k*, the cartilaginous septum of the outer nose. (The hard and soft palates of the roof of the mouth are shown at *k* and *g* in fig. 4, one of the nasal bones at *i*; *a* is the frontal bone with its sinuses, *b*; the latter lies just over the prominence called crista galli, of the ethmoid bone *c*; the large sphenoidal sinus is shown at *f*; *l* is the tip of the nose.) The medial bony partition is seen to be made up of the vomer or ploughshare bone, *e*, so called from its shape, joining the nasal vertical plate of the ethmoid bone, *d*, to the palate, *h*, *g*, and superior maxillary bones below, and with the sphenoid, *f*, above. The lateral boundaries of the cavity of the nose consist, as shown in fig. 5, looking at the left side of the nose, of the superior maxillary, *g* the palate, *e* the sphenoid (sphenoid sinus, *d*), *b* the ethmoid, *m n* inferior and middle turbinated, and the lacrymal bones: the roof being formed by *a*, the frontal, *b* the ethmoid, and *c d* the sphenoid bones, and the floor by *g*, the hard palate (the soft palate is at *h*) and superior maxillary bones. (In this figure *a* is the frontal, *e* the nasal bones, *f* the external nose, and *k* the opening of the Eustachian tube.) Lastly, the circumference of the posterior aperture, with its two nares divided by the septum, is formed by *c d*, the sphenoid, *g* the hard palate bones, and this outlet is into the pharynx or upper throat, roughly speaking level with the external nostrils. In the elephant, however, whose nose starts high in his head, the outlet into the throat is at a much lower level, and the nasal cavity slants rapidly downwards to the throat. The ethmoid bone sends out from the walls of the cavity of the nose, in practically all vertebrates, certain projecting and convoluted plates or turbinal bones, so formed as to divide the lateral surface into three portions. This formation is best seen in the section of a human nose at fig. 6, where *a* is the ethmoid and *g* the inferior turbinated bone. The ethmoid sends down a medial process, uniting with the vomer *e* and the hard palate *d*; also it throws out lateral processes at *f*, superior, and *k*, middle turbinals. It will be seen that the right of the picture is a section a little further forward than the left of the picture, to show how the bones differ as they retire. The cribriform plate of the ethmoid lies across the top of the nose at *a a*. The letters *k i l* mark the three meatuses, *b* is the orbit of the eye, *n* the great sinus in the cheek-

bone, *c*, called the *antrum*, opening into the nasal cavity. In man and in most animals these turbinals are of spongy bone, but in reptiles and batrachians they are cartilaginous. In dolphins they are altogether wanting. The whole median septum may also be cartilaginous, as in serpents, &c. The nasal chambers are comparatively very tall in man. In most animals they are much longer, the extremes of relative length being in the crocodile and great ant-eater. As in most vertebrates not belonging to the mammalia there are no palatal plates to prolong the floor of the nasal chambers, their noses are homologically only half the length of man; for instance, in birds, lizards, frogs, &c., the nose ends at the same relative point as about half-way through the nose of man, measuring from front to back. The continuous membrane which covers all this intricate surface, except the inferior turbinal, which is covered with ordinary ciliated mucous membrane, is called the pituitary or *Schneiderian* membrane. It is continuous with the skin in front and the mucous membrane of the throat behind, and in the nasal duct it meets and becomes identified with the conjunctival membrane of the eye. The pituitary membrane is thicker and more villous on the turbinated bones and the bony septum, pale and thin in the sinuses they enfold. Its surface is continually lubricated by mucus poured out from the surface of minute follicles; the function of the mucus is to protect the delicate surface, and by retaining and dissolving the odorous particles to assist the organ in its work. The odoriferous particles must be conveyed in air, but until they are dissolved in the nasal mucus they are not perceivable as odours. On the other hand, too great a flow of mucus, or a morbid condition of it, destroys the sense of it altogether, as a common cold and many diseases testify. In ordinary respiration odours are often not perceived; a more or less sharp effort, a sniff, is required to bring the odoriferous particles smartly against the sensitive surfaces. In fact, the lower part of the interior nose is respiratory, not olfactory. When we breathe with the mouth shut (as most people whose nasal cavity is in a healthy condition habitually do) the air passes in and out over the bony floor of the nose and so into the throat, passing beside the inferior turbinal, and hardly at all ascending into the septa above, where lie the olfactory nerves. When we have a bad cold in the head, and the membrane covering the inferior turbinal is swollen, the current of air is prevented from rising unless we make a great effort, and often is prevented from passing through the nose at all. If the inner nose be filled with fluid, even scented fluid, the sense of smell is entirely obscured, and does not recover for some time after it has been freed.

As was said, the olfactory lobes in man are really extensions of the brain; and they are in man rudimentary in size compared with their condition in many animals (*e.g.* the rabbit). In man they are slightly stalked or pedunculate, but they are in other animals often sessile, quite close to the cerebral hemispheres, as in the eels, or placed at the end of large diverging peduncles, as in the ray-fishes. They even exceed the cerebral hemispheres in size in some animals, as the lamprey.

The sense of smell varies considerably, both in degree and in kind, in different animals. It is evidently possessed by insects and many others of the lower animals, but the organs by which they exercise it are unknown. In the higher animals its degree of acuteness is in general marked by the extent of surface of the ethmoid and turbinated bones, over which the olfactory nerves are distributed. All vertebrates above fishes have the organ, and probably, therefore, the sense of smell, except whales, which are destitute of a nose. The remarkable expansion of membrano on the nose of the horse-shoe bats (see the illustration in the article BATS) is believed to be an apparatus for increasing the sensitive surface of the nose.

The olfactory nerve is appropriated exclusively to the sense of smell, and is incapable of perceiving pain or any other sensation. If stimulated in any way whatever it yields the sense of smell. But the origin of the odour always seems outside and not inside the nose. Smell is rather a slow sense, but it has a powerful effect mentally, and odours are among the sensations the most keenly remembered. Further, it is the quickest sense to be exhausted. The first sniff yields a powerful effect, but even at the second the sense begins to die. If two diverse and equally strong odours are offered to the two nostrils a sort of flickering sensation takes place; first one is perceived, and then the other. Of the peculiarities by which different animals are capable of perceiving only certain odours we know no more than of the nature of those odours themselves, of whose existence we have no other evidence than that of the sense which they affect.

The sense of smell serves as an adjunct to that of taste, and is subservient in most instances to the same purpose—of avoiding injurious food and providing proper aliment for the body. Many so-called tastes are really odours, such as those of wine, of aromatic plants, &c.; for these we really smell while we hold them in our mouth. Let but the nose be held, or a cold choke the higher passages with mucus, and the so-called tastes no longer exist.

NOSOLOGY (Gr. *nosos*, disease) is the term applied in medicine to the classification and arrangement of diseases. It was early found in the observation of the symptoms of disease, that many of them recurred very frequently, and hence to these groups of symptoms it was found convenient to assign particular names. It was not, however, till comparatively modern times that anything like a scientific arrangement was proposed. One of the earliest was that of Sauvages, who, taking the most prominent symptoms as his guide, divided them into ten great classes, under each of which was arranged numerous orders, each having its own subdivisions. The principle of this arrangement was adopted by several eminent medical writers, but it was supplanted by a system adopted by Cullen, which he promulgated in his “Synopsis Nosologicæ Methodicæ,” and which, from its simplicity, became very widely adopted. With the progress of medical knowledge, however, the imperfections of Cullen’s method became so apparent that many attempts were made to establish a sounder system. Dr. Farr, an eminent medical statistic, proposed a system of nomenclature, by which diseases were arranged in four primary classes, each of which included various orders, and his system was adopted by the registrar-general for the returns of mortality until the year 1869. The following is an outline of the system of nosology introduced by Dr. Farr:—

Class I.—Zymotic Diseases (Gr. *zmnē*, a ferment), diseases that are either epidemic, endemic, communicable, inoculable, capable of propagation from existing foci, or of generation; induced by a specific poison, or by insufficiency of food or its bad quality. In this class there are four orders, viz.:—Order I. *Miasmatic diseases*, such as small-pox, measles, scarlet fever, diphtheria, croup, whooping-cough, typhus and typhoid fevers, influenza, dysentery, diarrhoea, cholera, ague, &c. Order II. *Euthetic diseases*, such as syphilis, hydrophobia, glanders, malignant pustule, &c. Order III. *Dietetic diseases*, such as privation, want of breast-milk, scurvy, rickets, purpura, alcoholism, &c. Order IV. *Parasitic diseases*, such as scabies, worms, vegetable parasites, thrush, &c.

Class II.—Constitutional Diseases. This class is subdivided into two orders, viz.:—Order I. *Diathetic diseases*, which includes gout, anæmia, cancer, dropsy, lupus, mortification, &c. Order II. *Tubercular diseases*, such as scrofula, consumption, tubercular meningitis, hydrocephalus, &c.

Class III.—Local Diseases, divided into eight orders, arranged as follows:—Order I. *Diseases of the nervous system*, such as apoplexy, paralysis, epilepsy, insanity, &c.

Order II. *Diseases of the organs of circulation*, such as pericarditis, aneurism, varicose veins, &c. Order III. *Diseases of the respiratory organs*, such as bronchitis, pleurisy, pneumonia, asthma, &c. Order IV. *Diseases of the digestive system*, such as gastritis, peritonitis, enteritis, jaundice, &c. Order V. *Kidney diseases*, such as Bright’s disease, diabetes, nephritis, stone, gravel, &c. Order VI. *Diseases of the generative system*, such as hydrocele, and the various ovarian and uterine diseases. Order VII. *Diseases affecting the bones and muscles*, such as caries, necrosis, muscular atrophy, &c. Order VIII. *Skin diseases*, such as eczema, herpes, prurigo, acne, &c.

Class IV. Developmental Diseases, with the four orders of—I. *Diseases of children*, including premature birth, malformations, idiocy, teething, &c. Order II. *Diseases peculiar to women*, such as childbirth, change of life, &c. Order III. *Diseases attending old age*; and Order IV. *Diseases of nutrition*, such as atrophy, debility, &c.

A fifth class may also be specified, viz.:—*Violent deaths*, caused by accident, negligence, homicide, suicide, and the infliction of capital punishment.

In 1865 a committee was appointed to consider the subject of the nomenclature of disease, and after four years’ deliberations they issued, in 1869, a list of diseases with names adapted for the use of the English-speaking peoples, each name having its corresponding term in Latin, French, German, and Italian. The new classification was based upon anatomical considerations, and it was considered desirable that it should undergo periodical revision. The labours of this committee showed very clearly that in the present condition of medical science, it is impossible to devise a strictly scientific nosological system, and while the method adopted by the committee is convenient for practical purposes, a system at once exactly scientific and practically useful has yet to be devised.

NOSTALGIA (Gr. *nostalgiā*, to be home-sick), a home pain or restless desire for home, which often takes the form of a disease, especially among the Highlanders, Irish, and Swiss. It is marked by a speedy decay of the mental faculties, a gloomy and overpowering melancholy, and acute gastric symptoms. It frequently proves fatal to the sufferer.

NOSTOC. See *ALGÆ*.

NOSTRADAMUS, the assumed name of *Michel de Notredame*, a celebrated French astrologer, who was born at St. Rémi, in the diocese of Avignon, 13th December, 1503. He studied philosophy at Avignon and medicine at Montpellier, where he took the degree of doctor of medicine in 1529. He subsequently settled first at Agen, and afterwards at Salon, near Aix, in Provence, acquiring considerable celebrity by his zealous and successful labours during some terrible outbreaks of the plague. In 1555 he published at Lyons a number of enigmatical predictions written in verse in the form of quatrains, and arranged in three “centuries.” The apparent fulfilment of some of these prophecies gained him the favour of the superstitious Catherine de Medicis of France, and the lucky astrologer was invited to court and loaded with wealth and honours. The example of the queen was followed by the court, and some powerful princes and nobles became patrons of the prophet. In 1558 he published an enlarged edition of his predictions, in which the number of the centuries was increased to ten, the book being dedicated to the king, Charles IX. appointed him physician-in-ordinary to himself, and he retained his honours until his death, which took place at Salon, 2nd July, 1566. His “Centuries” have been frequently reprinted, and have been translated into several languages, one of the best editions being that issued at Amsterdam in 1668. See Baresté’s “Nostradamus” (Paris, 1842).

NOT GUILTY, PLEA OF, in criminal proceedings, is a general denial of the accusation, and puts the prose-

cutor to the proof of every material fact alleged. When a prisoner is mute or declines to plead, the court always records the plea of not guilty, so putting everything in issue.

NOT NEGOTIABLE. See *CURQUE*.

NOT PROVEN, a verdict used in criminal trials in Scotland. The import of a verdict of not proven is merely to express the opinion of the jury that the evidence adduced by the public prosecutor to substantiate the charge against the panel is insufficient for this purpose. It does not negative the guilt of the panel; but whatever evidence may come to light afterwards, the accused cannot be again indicted for the crime for which he has been tried.

NOTABLES, ASSEMBLY OF, a famous assembly which from time to time had been convoked in France to decide great questions of state. It was, like the earlier forms of the great council of England, drawn entirely from the upper classes. In 1787, therefore, the minister Calonne, when absolutely bankrupt, thought that in this assembly, not summoned since Richelieu's notables in 1626 (who were only thirty-five in number), he should find a body far more docile than either the states-general, wherein all classes entered, and which therefore had been left alone since 1611, or the more frequent assemblies of lawyers called *parlements*. Calonne's plan was to quiet the turbulent people by reforming abuses, to extend the stamp duties, and to convert the tax called the *twentieth* into a tax upon all landed property, including that of the clergy. Asked for the reason of this monstrous proposition to tax the nobility and the clergy, till then practically tax-free, Calonne pointed to the loans of 1,640,000,000 livres in all and to the permanent deficit of 115,000,000 on the revenue. The outcry from the 144 members was so furious upon these revelations that Calonne not only had to resign, but to fly the country. Loménie de Brienne succeeded him, but had to abandon the stamp duties and land tax, and in despair dismissed the unworkable assembly after a session of nine weeks. It was again convoked, with the same members, by the minister Necker, 6th November, 1788, to decide upon the mode of organizing the states-general, and sat for one month. Only one bureau out of six declared in favour of the double representation of the *tiers état* (commons), which the people had demanded. Again, and for the last time, the notables, after a month's useless debating, were dismissed, and the Revolution took its own course.

NOTACANTH'US is a very aberrant genus of fishes belonging to the order Acanthopterygii, forming the family Notacanthidae. The body is elongated and covered with very small scales. The dorsal fin is short, and composed of short isolated spines, the soft portion being absent; the anal fin is very long; the ventrals are abdominal. A conical snout projects beyond the mouth. Five species of this singular genus are known, all deep-sea fishes from the Arctic Ocean, Mediterranean, Atlantic, and South Pacific.

NOTARI'CA, a catch-word made of the initials of words forming some characteristic sentence. Such devices are now not used; but some of the most successful specimens of the past are the following:—*Smectymnus*, the author's name adopted by S. Marshall, E. Calamy, T. Young, M. Necomen, W. or UU. Spurstow, who wrote a joint-book against the Prayer-book and Episcopacy in 1641. (Young was Milton's former tutor.) "When *hempe* is spun, England is done" (Henry, Edward, Mary and Philip, Elizabeth), a prophecy heard in his youth by Bacon, and moreover fulfilled—since James I. was "King of Great Britain and Ireland," not "King of England" like his predecessors. *Clio*, the muse of history and heroic poetry, one of the letters of whose name Addison always used to sign his *Spectator* essays with, according as he wrote from Chelsea, London, Islington, or the Office. *Cabal*, the first cabinet council under Charles II., composed of Clifford, Ashley, Buckingham, Arlington, and Lauderdale. *Hep! hep!* the

medieval rioters' cry against the Jews, "*Hierosolyma Est Perdita*" (Jerusalem has fallen), sometimes regarded as forefather of our "Hip, hip, hurrah." *Acio*, Frederick II.'s device, "*Austria Est Imperare Orbi Universo*," Englished (very freely) as "Austria's Empire Is Over all Universal," and parodied by moderns in Austria's declining days as "Austria's Empire Is Obviously Upset."

NOTARY. This word is derived from the Roman name *notarius*, a person who was so called from his taking down in notes or writing (*notae*) the words of a speaker. The *notarii* were shorthand writers, and used symbols of abbreviation.

It is generally supposed that the power of admitting notaries to practise was vested in the Archbishop of Canterbury by the 25 Henry VIII. c. 21, s. 4. The term of service and the manner of admission to practise are regulated by the 41 Geo. III. c. 79, and 6 & 7 Vict. c. 90.

The original business of notaries was to make all kinds of legal instruments; they are often spoken of in former times as the persons who made wills (Shepherd's "Touchstone," vol. ii., p. 407, Preston's edit.); but solicitors have now got possession of this part of their business. In practice their business is now limited to the attestation of deeds and writings, for the purpose of giving them such authenticity as shall make them admissible as evidence in other countries, but principally such as relate to mercantile transactions. It is also their business to make protests of bills of exchange. They also receive and take the affidavits of mariners and masters of ships. By 16 & 17 Vict. c. 59, notaries in the country are expressly empowered to act as conveyancers.

In Scotland the position of notaries is somewhat higher than in England. They are admitted by the Lords of Session, and have power "to take instruments in any honest and lawful business, which instruments make faith in law." They are required for the attestation of deeds, wills, &c., when the maker cannot write. Formerly their intervention was necessary in the transmission of feudal rights. They still are entitled to act as conveyancers.

NOTATION is the expression of terms in music, in algebra and arithmetic, in chemistry and other sciences, &c., by written symbols. See *NOTATION OF MUSIC*; *NUMERALS*; *NUMERATION*; *ALGEBRA*; *NEGATIVE QUANTITIES*; *ELEMENTS*; *SYMBOLS*, *BOTANICAL*; and the article immediately following this.

NOTATION, CHEMICAL. Almost every branch of knowledge, as soon as it attains the development essential to science, feels the necessity of embodying its results in characters briefer, more compact, and less ambiguous than ordinary language. This want is founded in the very nature of the human intellect. Place before us a number of facts in such a manner that the eye can seize them at a glance, and we not only clearly apprehend and remember them with ease, but can readily detect their mutual relations. But convey them in loose, colloquial language, and they will, as a matter of course, be vaguely apprehended, while all attempts at ascertaining their mutual bearings will be highly difficult. We meet with continued attempts at symbols in the writings of the alchemists, but these crude beginnings were rather concealments of knowledge than aids to research. Remnants of them may be seen in the characters sometimes inscribed on the show-bottles in the windows of our apothecaries. No useful and intelligible system was possible until the establishment of our modern notion of *elements*, or simple undecomposable bodies, by whose combinations all matter is formed. To adopt a symbol for each element was to give, as it were, the alphabet of the system. Accordingly the initial letter of the Latin name of each was adopted as its symbol. See *ELEMENTS, CHEMICAL*.

Whenever the names of two or more elements have the same initial, the second or third letter is added by way of

distinction. The following list gives the symbols and atomic weights (the weight of the hydrogen atom being taken as unity) of the elementary bodies at present recognized:—

	Symbol.	Atomic Weight.
Aluminium,	Al.	
Antimony (<i>Stibium</i>),	Sb.	122.0
Arsenic,	As.	75.0
Barium,	Ba.	137.0
Beryllium or Glucinum,	Be.	9.1
Bismuth,	Bi.	208.0
Boron,	B.	11.0
Bromine,	Br.	80.0
Cadmium,	Cd.	112.0
Cæsium,	Cs.	133.0
Calcium,	Ca.	40.0
Carbon,	C.	12.0
Ceium,	Ce.	137.0
Chlorine,	Cl.	
Chromium,	Cr.	
Cobalt,	Co.	59.0
Copper (<i>Cuprum</i>),	Cu.	63.5
Didymium,	D.	114.0
Erbium,	E.	170.6
Fluorine,	F.	19.0
Gallium,	Ga.	69.8
Gold (<i>Aurum</i>),	Au.	197.0
Hydrogen,	H.	1.0
Iodine,	I.	127.0
Iridium,	Ir.	193.0
Iron (<i>Ferrum</i>),	Fe.	56.0
Lanthanum,	La.	139.0
Lead (<i>Plumbum</i>),	Pb.	207.0
Lithium,	Li.	7.0
Magnesium,	Mg.	24.0
Manganese,	Mn.	55.0
Mercury (<i>Hydrargyrum</i>),	Hg.	200.0
Molybdenum,	Mo.	96.0
Nickel,	Ni.	59.0
Niobium,	Nb.	94.0
Nitrogen,	N.	14.0
Osmium,	Os.	199.0
Oxygen,	O.	16.0
Palladium,	Pd.	106.0
Phosphorus,	P.	31.0
Platinum,	Pt.	197.2
Potassium (<i>Kalium</i>),	K.	39.0
Rhodium,	Rh.	104.0
Rubidium,	Rb.	85.0
Ruthenium,	Ru.	101.0
Selenium,	Se.	79.0
Silicium or Silicon,	Si.	28.0
Silver (<i>Argentum</i>),	Ag.	108.0
Sodium (<i>Natrium</i>),	Na.	23.0
Strontium,	Sr.	87.5
Sulphur,	S.	32.0
Tantalum,	Ta.	182.0
Tellurium,	Te.	125.0
Thallium,	Tl.	204.0
Thorium,	Th.	231.5
Tin (<i>Stannum</i>),	Sn.	118.0
Titanium,	Ti.	48.0
Tungsten or Wolfram,	W.	184.0
Uranium,	U.	240.0
Vanadium,	V.	51.0
Yttrium,	Y.	88.0
Zinc,	Zn.	65.0
Zirconium,	Zr.	90.0

These symbols are common to the scientific men of all nations, and form a kind of universal language. The consideration which gives these symbols their scientific value is dependent upon the ATOMIC THEORY. The symbol O denotes not merely oxygen in the abstract, but one atom of oxygen, the weight of which is sixteen times that of the hydrogen atom; therefore this number is called its *atomic weight*. H, in like manner, stands not for hydrogen in general, but for one atom of hydrogen. Consequently, when we represent water by the formula H_2O , we not merely state that it consists of hydrogen and oxygen, but that it is composed of 2 parts by weight of hydrogen united to 16 parts of oxygen. Thus by a couple of letters we convey more clearly what would require perhaps as many lines to express in common language. In order to represent several atoms figures are placed to the right of the symbol to indicate the multiples. Thus O_3 means 3 atoms of oxygen or 48 units of weight, and C_6 represents 6 atoms or 72 units of weight of carbon. The *molecule* or smallest portion of a compound substance which can exist as such, is represented by grouping the symbols of the atoms of which it consists, and indicating the number of each as above explained. Thus the molecule of water consists of 3 atoms, 2 of hydrogen and 1 of oxygen, or H_2O , and its *atomic weight* will be the sum of the weights of the elements of which it is composed, or $2+16=18$ units of weight. When it is necessary to represent several molecules of a compound body, their number is indicated by a figure placed *before* the whole symbol. Thus $2H_2O$ represents two molecules of water, $7H_2O$ seven molecules, &c. As a further illustration, the molecule of alcohol consists of 2 atoms of carbon, 6 atoms of hydrogen, and 1 atom of oxygen. Its symbol is therefore C_2H_6O , from which the chemist understands that it contains 24 units of weight of carbon, 6 units of hydrogen, and 16 units of oxygen, and that the total atomic weight of the molecule is 46 units. Thus the single letters stand for atoms, and the terms formed by grouping the letters represent molecules.

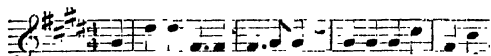
These symbols are generally arranged according to certain rules. In a compound consisting of two elements, the more electro-negative is placed to the right hand—as, water, H_2O ; potash, K_2O ; hydrochloric acid, HCl . In the formula of a salt, the acid stands to the right hand and the metal to the left—as, sulphate of manganese, $MnSO_4$. Water of crystallization is generally placed at the extreme right of the formula. Thus crystallized sulphate of manganese is $MnSO_4 \cdot 7H_2O$, or as it is sometimes represented, $MnSO_4 \cdot 7Aq$. A figure to the left hand of any portion of a formula multiplies all that follows until the next comma or full stop, and a figure before a parenthesis multiplies all therein included. Thus, $2NaHSO_4 \cdot 3H_2O$ (sodium bisulphate) means that the formula $NaHSO_4$ is multiplied by 2, and combined with H_2O multiplied by 3. Again, the double sulphate of manganese and potassium is represented thus, $MnK_2(SO_4)_2 \cdot 6H_2O$. Here 1 atom of manganese and 2 of potassium are combined with the formula SO_4 multiplied by 2, and the whole with the formula H_2O multiplied by 6.

Chemical symbols are very usefully applied to exhibit the results of any reaction, decomposition, &c. Here the two members of the formula, like the two sides of an algebraic equation, or of a ledger account, must exactly balance, every element which has entered into reaction being accounted for, according as it has entered into some new combination, escaped in a gaseous form, &c.; as the total quantity or weight of matter dealt with is incapable of alteration, however, its constituent parts may be regrouped.

NOTATION OF MUSIC signifies the method whereby the pitch or tune and duration of musical sounds are represented, and by which definite periods of silence, called rests, are marked. It is to music what letters and punctuation are to language.

To show the pitch, the Greeks used the letters of their alphabet placed in various positions. [See GREEK MUSICAL SYSTEM.] The following are the two first lines of the famous "Hymn to Kalliope," one of the three pieces of ancient Greek music found by Vincenzo Galilei, father of the astronomer, with their interpretation:—

σ 7 Z. φ φ φ σ σ
 "Αἰὶδι, Μουσά, μοι φίλη
 σ σ σ σ φ Μ Μ
 Μολπῆς δ' ἔμης κατάρχην.



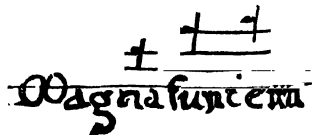
The time is not indicated, but the interpretation follows the quantity of the syllables. The Romans had recourse to the majuscules (capitals) of their own alphabet for the purpose, till the latter part of the sixth century, when Pope Gregory I. employed the seven first capital Roman letters for the first septenary, beginning with the A, answering to the lowest space in our bass staff. For the next ascending septenary he used the corresponding small letters; and the third he denoted by the same small letters doubled. Other ancients, as Boethius, used fifteen or more letters, but still somewhat in the same lines. The Roman system of lettering, whether due to Gregory or, as is perhaps more likely, to later times, was at all events in full use at the time of Guido's treatise, written by this Aretime monk in the eleventh century. A specimen of Guido's letter-notation, taken from his "Micrologus," is given in the article GUIDO, with its interpretation.

Letter-notation still survives in the naming of our notes, and it is very curious that our pianofortes, by gradual extension towards the bass, now begin with A, the name originally given to the lowest note of the ancient organs; but our present lowest A is two octaves beneath the note which originally "began music." Letters are also still used in our clef signs, which are only altered forms of F, C, and G. See CLEF.

Side by side with the letter notation, and finally (about the time of Guido) completely overcoming it and driving it from the field, grew up a notation by NEUMES or signs, as described in the article on that subject, the *neumes* rising or falling as the pitch was meant to rise or fall, and being in themselves either one note or a group of notes, each sign of course always bearing its characteristic interpretation. About the year 900

a red line drawn across the parchment indicated the note which lies in the middle of an ordinary man's voice—the note we call Bass F; and the convenience of this was so manifest in fixing somewhat the relative pitch of the neumes that a yellow line for the note we now call Middle C was soon afterwards added, much medieval music lying between these two notes or a little beyond on either side. As colours were not always available, the letters F and C were in such cases written across the lines at their beginning, and they were drawn in black in many MSS. So grew up the clefs. Guido, or someone else at the beginning of the eleventh century, completed the principle of the staff by dividing the interval between the lines F and C with a black line (A); and as the three lines were now a Third apart (F, A, C), it was evidently easy to add a second black line a Third above the yellow, serving for E, and completing the four lines of the medieval staff. In the Bodleian Library at Oxford is the oldest piece of music with a four-lined staff, the lines and spaces used as at present. It is believed, on almost indisputable evidence, to be the *Missal* of Ethelred II.

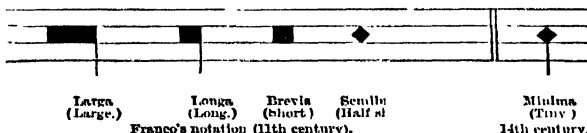
(it contains a prayer for his welfare). Ethelred died in 1016, and the book is therefore anterior to that date. It was long preserved in Winchester Cathedral. Curiously mixed up in the *Missal*, along with this great improvement, is the older system of rising and falling neumes, even without lines at all; probably due to two different scribes, of different accomplishments, having been engaged upon the work. We may at all events assume that by the middle



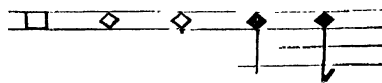
Missal of Ethelred II.

of the century the notation of pitch was well established. The neumes died down to but one or two varieties, and very little more than the simple point was used, signifying one note, since it was found quite easy to represent any desired group by a combination of points. Still the notation of time was entirely neglected. The Greek system, the Latin system, and the mediæval neumes had alike left the length of the tones to be expressed merely by the syllables sung to them. The monk Franco of Cologne, about the close of the eleventh century (the date is contested, but seems still preferable to any other suggested), published, as Guido had done at the beginning of the same century, a music-book containing his own inventions and what had been invented by others up to that time; and in this book of Franco's we find the first idea of representing time musically by varying the shape of the points or notes. Each note is to be the triple in value of the note next beneath it in the scale (for three is held to be the holy and perfect number, in honour of the Trinity), or in certain cases, carefully enumerated, only the double, as with ourselves, and in the latter case the division was said to be *imperfect*.

Franco's forms of notes are four; two derived from the nail-like neume called *virga*, and two from the point.



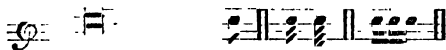
The large *be* calls double-long, but it soon got its more characteristic name. The *minim* first appears in the works of John de Muris (fourteenth century); soon after a *semi-minim* is found; and by the close of the century even a *croma*, the half of a semi-minim. At the same time it became increasingly customary to outline the older notes instead of printing them all in black, the younger ones being left black by way of more perfect distinction. The notation during the fifteenth and sixteenth centuries was of the following form, and was written on a staff of five lines:—



Large Long Brevis Semibrevis Minima
 Notation of the 15th and 16th cent.

We now call a semi-minim a crotchet, and a croma a quaver. [See NOMENCLATURE.] We abandon the large and the long, and write the remainder, except the breve, in

rounded outlines, but no further change is made, beyond the readiness with which we subdivide our quaver by add-



Notation of the 18th and 19th centuries
(Large and long absent, the breve now a rare note, and the semibreve the longest in frequent use.)

ing hooks, each addition of a hook halving the value of the sign, and the binding of hooked notes into groups by joining the hooks together so that they become hands.

A very important difference in the relative value of notes was made about the year 1600, namely, that each note should be the double, and not the triple of the note next beneath it in the scale of values; but just as the older composers found they needed dupe division as well as triple, so also their descendants provided for an occasional triple division by means of a dot following the note: a note so dotted is triple the value in time of the note next below it in the scale of values. This dot was one of a number of dots used for various purposes in the mediæval notation which arose out of Franco's time-table, one of these purposes being "augmentation," that is, the enlarging of the time-value of a note by half. All the other uses of the dot have, however, vanished.

At the same time with the change from triple to dupe division came the use of bars, to keep the notes on the various staves well under one another, but not, at first, to mark accent. The composer drew a bar here and there as he thought fit, and as he scored it right across the page, such a barred piece of concerted music has ever since been called a "score." At certain points a heavy bar was drawn, marking a close. If that portion were to be played twice a double-bar || was drawn; if thrice a triple-bar |||, and so on. Of these bars only the double-bar now remains; and that needs dots along its side if repetition is intended to be marked; dots on one side now serving for the portion on that side of the bar, dots on both sides indicating similarly that both the portions of music separated by the double-bar are to be repeated. If the double-bar has not these dots it marks the close of one division of the movement, just as the old single-bar did. The use of lightly drawn bars to cut up the piece into measures or equal groups of accents, the bar-line being placed before the principal accent of each measure, began in the latter half of the seventeenth century, Lawes being the first composer known to have used them. See BAR.

The origin and introduction of ACCIDENTALS, the flat and the NATURAL (tenth century), and the SHARP (thirteenth century), is accounted for in those articles, and the use of SIGNATURES, both of time and key, is given under that heading. Directions for performance (*adagio*, *allegro*, &c.) are found in music soon after 1600, and marks of expression (*f. p.*, *mf.*, &c.) came in towards the close of the same century, *q. o. o.* in their present form. The signs for crescendo and decrescendo $<$ $>$ were not used till early in the eighteenth century, and along with them arose the dots above notes, which indicate the staccato, the slur \frown to mark the legato, and some other signs. The pause \cup is found as early as 1508.

NOTHING. In the article INFINITE will be found as much upon this word as will enable us to dispense with the consideration of the symbol 0 as the limit approached, but never attained, by the continual diminution of magnitude.

Among the terms used in mathematical language are *nothing*, *cipher*, and *zero*. The first word, *nothing*, implies the absence of all magnitude, but its occurrence denotes either that magnitude did exist, or might have existed, or does exist under similar circumstances in other problems, or in the same problem under different points of view. Were it not for this the word would be useless; thus we do not consider it necessary to speak of £20 gen-

erally as twenty pounds, no shillings, no pence, and no farthings. But if this £20 had been the amount of a number of sums, the symbol £20 0 0 would be useful as indicating that the results of an operation (addition) had left no quantities in places where beforehand quantity might have been expected. The term *unity* would have been useless in the same manner, except as a tacit reference to other units. Anything we please is *one* of its kind, and accordingly the indefinite article (*a* or *an*), which is certainly *one* in etymology, has lost its definite monadic signification, because such signification is useless. This point is of some importance to the mathematician, as justifying the use of the symbol 0 where it might seem redundant. The 0 and 1 are frequently used as symbols of distinction where they are not wanted as symbols of operation; in like manner, in common language, the simple phrase "*one ox and no sheep*," though it implies no more of positive conception than the more simple phrase "*an ox*," may be a proper description where the second would be no such thing.

The cipher is 0 considered in a purely arithmetical point of view, as the mode of denoting a blank column intervening between or following columns which contain significant numbers.

The term *zero* considers 0 rather as a starting point of magnitude than as the symbol for the recognition of absence of all magnitude, and really denotes, not the entire absence of magnitude, but the arbitrary determination to reckon all magnitudes by their excess or defect from a certain zero magnitude. Thus the zero point of the thermometer does not mean that shown when there is no temperature, but a certain temperature—that of freezing water; and degrees above and below zero indicate excesses or defects of temperature above or below that standard. It is then perfectly proper to say that 10 degrees below zero is a lower temperature than 5 degrees, and that both are less than zero.

NOTICE, in law, that formal notification by which a person communicates or receives the presumed or real knowledge which subjects the receiver to legal liabilities. Such is the notice to quit, which must be exchanged between landlord and tenant in the ordinary case of a twelve-month's tenancy, if either desires to terminate it six months before the expiry of the current year.

In Scotland the more general phrase is "intimation" or "warning." Notice is, however, also used—principally in statutory proceedings and in relation to bills of exchange.

NOTING BILLS (dishonoured). See PROTEST.

NOTTINGHAM or **NOTTS**, an inland county of England, is bounded N.E. and E. by Lincolnshire, S.E. and S. by Leicestershire, W. by Derbyshire, and N.W. by Yorkshire. Its greatest length, north by east to south by west, is about 51 miles; its greatest breadth, at right angles to its length, is 26 miles. The area is 825 square miles. The population in 1881 was 331,984. Nottingham is the Old English *Snottingham*, i.e. "place of caves," there being many caves in the soft sandstone rock. In one of these, still called "Mortimer's Hole," Mortimer had taken refuge when the boy-king Edward III. arrested him with his own hand.

Surface and Rivers.—The surface of the county is undulating, except in the vales of Trent and Belvoir; but there are no very high hills. Beacon Hill, the Wolda Hills, and Sherwood Forest, the scene of Robin Hood's exploits, occupy the highest ground.

The strata which form the surface of this county succeed each other in order from east to west. The eastern and south-eastern borders are chiefly occupied by the lias. The vale of Trent and the uplands to the west of it are for the most part composed of rocks of the red marl or new red sandstone group. The newer magnesian or conglomerate limestone underlies the red marl; but in some parts these

formations are separated by beds of quartzose gravel, extending to the depth of 600 and 900 feet. West of the magnesium limestone occurs the great coal-field of South Yorkshire, Derbyshire, and Nottinghamshire, of which only a comparatively small part is comprehended in this county. Between Mansfield and Nottingham the limestone immediately overlies the coal, but south-west of Nottingham the coal-measures crop out from beneath the red marl which occupies the valley of the Trent. Coal, gypsum, and building and paving stone are sufficiently plentiful.

The whole county belongs to the basin of the Trent, which river flows through it 25 miles in a north-east direction to the neighbourhood of Newark; below Newark it turns to the north, and flowing first within and then upon the border of the county 25 miles further, to below Grainsborough (Lincolnshire), finally quits the county and flows through the marshes of the Isle of Axholme to the Humber. That part of its course which appertains to this county is about 53 miles. The Idle, after a course of 47 miles, flows into the Trent, receiving in its course the waters of the Rainworth, Mann, Meden, Wollen, Poulter, and Rayton. The Soar has about 8 miles of its course, navigable throughout, on the border of this county and Leicestershire, to which latter it belongs. The Erewash, the Lene, the Dover Beck, the Deven, and some of their small tributaries, flow through this county into the Trent.

The Erewash, the Cromford, the Nottingham, the Grantham, and the Chesterfield canals pass through the county; as likewise do portions of the Midland, the Great Northern, and Sheffield and Lincolnshire railways.

Soil, Agriculture, and Manufactures.—The climate is dry and healthy, and upon some of the light lands the harvest is as early as in many counties more to the south. With respect to soil, it may be divided into three districts. In the first sand and gravel prevail. This extends along the vale of Trent to the borders of Lincolnshire, and to the north of Nottingham along the ancient forest-land and border, in a strip of land about 30 miles long and from 7 to 10 miles broad. The next is the clay, which lies between the Trent land and the last-mentioned strip, and in a part of the southern extremity of the county towards Leicestershire. The third district is that where limestone and coal are found. This lies partly on the borders of Derbyshire, and partly on the south-east, towards Leicestershire and Lincolnshire.

Before the inclosure of the forest lands and the commutation of the forestal rights, a great portion of the land could not be cultivated to advantage or improved. The practice of leaving it in grass for several years, and then breaking it up for a course of cropping, prevailed in most parts of the county; but it is now better regulated, and a modified convertible system has been introduced, to which the lighter soils are well adapted. The farming generally is good; the best implements are used, and almost everywhere the land is well drained. Along the river Trent lie some very good meadows and pastures.

Excellent market gardens abound in the neighbourhood of Newark, Nottingham, and other towns, the sandy soil being very favourable to the cultivation of roots and vegetables. There are some good orchards on the heavier soils. According to the official agricultural statistics the area under cultivation in 1885 was 450,000 acres, of which 140,000 acres were devoted to corn crops, 50,000 to green crops, and 190,000 to permanent pastures. The number of cattle in the county at the same time was 80,000, and of sheep 220,000. Much cheese is made in the county. Shorthorns are the most prevalent breed of cattle, and Leicesters that of sheep, but the Down sheep have been largely introduced, and half-breeds are common.

Nottingham is the centre of the lace trade in England, and there are also worsted, cotton, and thread manufactories, ironworks, bleachworks, paper-mills, and tanneries.

Coal-mining has much extended, and over 4,000,000 tons are annually raised.

Nottinghamshire is in the Midland circuit, the assizes being held at Nottingham. Under the Redistribution of Seats Act of 1885 the county returns seven members to the House of Commons, four for single member divisions of the county, and three for the borough of Nottingham.

History, Antiquities, &c.—In the earliest period of British history the county seems to have formed part of the territory of the Coritani. In the division of the island by the Romans it was included in the province of Flavia Cæsariensis. Many Roman remains have been discovered near Newark, and the foundations of a Roman villa at Mansfield Woodhouse. After the Conquest, the greater part of the county, together with the Castle of Nottingham, was bestowed by William the Conqueror on his natural son, William Peverel. At the commencement of the civil war of Charles I. the king set up his standard at Nottingham with great ceremony in 1642. Monk with his army marched through the county, passing through Mansfield, Southwell, and Nottingham on his way southward in 1660 to restore Charles II.

Of architectural antiquities Nottinghamshire is somewhat barren. Of the monastic ruins the most picturesque are those of Newstead, famous as the seat of Lord Byron, who has described it with great elegance in his poem of "Don Juan." Here was a priory of Black or Austin canons, founded by Henry II. about 1170. Colonel Hutchinson the Puritan, and Henry Kirke White the poet, were natives of Nottingham.

NOTTINGHAM, the capital of the above county, is a municipal and parliamentary borough, 125 miles N.N.W. from London by the Midland Railway, situated on the north bank of the river Lene, about a mile north from the Trent. The town stands on a slope, is unusually well built, and drained in a very thorough manner. The water supply is also ample and good, so that as regards health Nottingham stands very high among the large manufacturing places of England. Its castle, entirely modern, and without a castellated appearance, stands on a perforated sandstone rock, the site of the old fortress in which Mortimer was seized by the friends of Edward III., who gained admission to it by a subterranean passage still indicated under the name of "Mortimer's Hole." The market-place occupies an area of $5\frac{1}{2}$ acres, and is surrounded with lofty buildings. The principal public buildings are—the fine parish church of St. Mary's, which was restored in 1867 at a cost of several thousand pounds; about a dozen other episcopal churches; a handsome Roman Catholic cathedral; several dissenting chapels; the exchange and assembly-rooms; post office; theatre; concert hall, masonic hall; library of 40,000 volumes; county and town hall; gaol; cavalry and infantry barracks; general hospital; two lunatic asylums, &c. There are numerous schools, including a handsome grammar-school erected in 1868, with an annual income of £1000, many charitable institutions, and a congregational theological college built in 1868. The Midland Counties Art Museum was opened in 1878, and the university college, divided into three sections—the free library, the natural history museum, and the scientific and chemical department—was erected in 1879–80. The museum is in the castle, which was formerly the residence of the dukes of Newcastle, but was burned by the mob in the Reform riots of 1831. It was restored in 1877–78. In 1871 the old bridge over the Trent gave place to one of stone and iron, 700 feet long and 40 wide, which cost £30,000. Nottingham is the great centre of the lace and bobbinet manufacture in England, besides which it has silk, cotton, and flax mills; manufactures of hosiery and machinery; large bleaching works, malt-houses, breweries, dye-works, and wire, pin, iron, and brass factories. The parliamentary

borough returns three members to the House of Commons, one having been added by the Redistribution of Seats Act of 1885. The population in 1881 was 111,618, but the limits of the new borough have been extended, and contains 136,575 inhabitants.

Nottingham claims to be a borough by prescription, but received charters from Henry II. and many subsequent monarchs, Henry VI. having granted to it the additional privilege of being a county of itself. It is divided into sixteen wards, and is governed by a mayor, sixteen aldermen, and forty eight councillors. The first attempt at the manufacture of lace by machinery dates as early as 1768, when Hargreaves brought his spinning jenny from Blackburn. In the following year Arkwright erected his spinning frame. It was not, however, till 1809 that Mr. Heathcoat of Tiverton discovered the correct principle of the bobbin-frame, and obtained a patent for his invention. Steam-power, first introduced in 1816, and becoming general in 1822-23, gave a great stimulus to the trade, which was further increased on the expiration of Heathcoat's patent. Prices fell in proportion to the increased production; and the Nottingham lace frame soon became the means of general supply, rivalling and supplanting, in plain nets, the most finished productions of France and the Netherlands, so much so that large quantities were smuggled into those very countries from which lace was formerly smuggled into England.

The origin of Nottingham is involved in obscurity; but so early as in the time of Alfred, it was of sufficient importance to give its name to the county. The castle was built by William Peverel, the natural son of William the Conqueror. Edward III. held several parliaments here, in one of which were enacted the laws relating to the settlement of the Flemish manufacturers. Nottingham was the chief place of rendezvous for the troops of Edward IV. and Richard III. during the Wars of the Roses; and it was here, in 1642, that Charles I. formally raised his standard against the Parliament. The inhabitants, however, being attached to the republican cause, the king was soon compelled to abandon the town and castle to the Parliamentary forces. Nottingham has been the scene, in more recent times, of disturbances among the working classes. In 1811, when considerable distress prevailed among the weavers in consequence of the exclusion of British produce from the continental markets, combinations were formed among the workmen for the purposes of breaking the frames, which they erroneously supposed had thrown them out of employment; and to such an extent did they proceed, as to call for the most vigorous interference of the legislature. Disturbances of a minor nature occurred several times afterwards; but the only serious riot took place on the 8th October, 1831, during the agitation preceding the passing of the Reform Act, when the rioters burned down the castle.

NOUMENON and **PHENOMENON**, contrasted terms of the ancient philosophy, which mean "realities and appearances," "substance and qualities," &c. Anaxagoras was the first formally to teach that the senses only perceive phenomena; the noumena or things-in-themselves they are powerless to show us. The controversy has ever since continued, as to whether we can or cannot perceive more than phenomena. The antithesis of noumena and phenomena is due to Plato. Kant also adopted these terms, and it is rather unfortunate that he did so, since ancient terms acquire connotations during their long existence which sometimes, as in his case, prove very awkward in leading philosophers who use them to convey more than they actually mean, and so themselves to get occasionally confused in intricate arguments.

NOUN, one of the "parts of speech" into which grammarians have distributed the words of a language. The noun generally expresses the subject of discourse, or the

name (Lat. *nomen*) of the thing spoken of, as horse, table, darkness, &c.; but it may also be used as the predicate, as in the sentence "Tin is a metal," where both tin and metal are nouns.

So far as respects the form of nouns, that is, the sounds of which they are composed, they are capable of classification in all languages. The nature of this classification may be explained from examples in our own language. Many nouns are simple roots, as horse, ship, man, tree; while others are formed by adding a suffix to the root or other words, as build, build-er; king, king-dom, &c.

The noun being one of the principal inflected forms of our speech in its earliest stage, when it showed three genders, three numbers, and five cases, and had five varieties of declension, exhibits very forcibly the alterations caused by the attitudinal of time. But little change can be found in the earliest English of the Chronicle down to the Norman period; then (about 1100) a rapid change in orthography set in, and was followed (about 1150) by an equally rapid change in the direction of simplification of grammar, dropping case-endings and the dual number, &c. After this a large admixture of French came in, and English became a composite language. An example will make this very clear; and nothing could be better than a phrase of Ælfrie's homily, "De Initio Creature," extracted from successive editions:—

About 1000,	He is calra cyninga cyning.
" 1100,	He is calra kingene kyng.
" 1150,	He is alra kynges kyng.
" 1400,	He is of all kings king.

At the present time nouns are not altered except for the plural, when nearly all take *s* or *es*, and for the genitive, when all take *'s*. Some few nouns retain modifications of older plurals; as oxen, brethren, children; and a few others form the plural by vowel change, omitting the rest of the ancient plural sign, as foot, feet; tooth, teeth; man, men; mouse, mice; goose, geese; a few others, as deer, sheep, swine, do not change. Adms, riches, caves, summons are all of them strictly singular nouns in origin as well as use; wages, pains, news, odds, sessions, bellows, amends, tidings, gallows, plurals by origin, are now regarded as singulars. We still have a few genuine feminines retained; the common old feminine suffix *en* is seen in vixen (she-fox), and the still commoner old feminine *ster*, answering to the masculine *ere* (as *beccere*, *bacestre*), is seen in spinster, seamstr(ess), songstr(ess), the two last adding an unnecessary second feminine suffix of Norman origin. The suffix *ess* is indeed now our usual feminine, as giant, giantess, &c. We also use the Romance *a*, as sultan, sultana, or *ine*, as hero, heroine, and the Latin *ix*, as testator, testatrix.

It is remarkable how many very ordinary nouns in modern English have no feminines whatever, and, as of course follows, how many feminines have no masculine. The list contains father, brother, uncle, nephew, son, boy, husband, bachelor, king, sire, lord, earl, wizard, sloven (feminine, slut); and in animals, bull, boar, buck, hart, stag, ram, dog, stallion, colt, cock, gander, drake, drone. It is needless to give the equally well-known feminines which pair with these.

Most of our best grammarians prefer to include adjectives with substantives under the heading noun, since both alike serve to describe the qualities of things; but as yet popular usage restricts noun to the meaning of substantive.

NOUREDDIN' (*Noor-ed-Deen*), the Seljuk sultan of Syria, and later on of Egypt, the chivalrous foe, and afterwards the loyal friend of BALDWIN III., king of Jerusalem (1142-62), was the predecessor of the better known SALADIN (*Salah-ad-Deen*), whose character closely resembled his own. His full name was Malek-al-Adel Noouredin-Mahmud; he was born in 1118, and succeeded

his father in 1145. His conquests in Syria at the expense of Baldwin III. brought about the second Crusade in 1147 (under Louis VII. of France, and Conrad III. of Germany), but the Christians were thoroughly worsted. Noureddin compelled them to raise the siege of Damascus, 1148, and completely defeated Raymond, prince of Antioch, near Antioch, 1119, after which the Crusaders returned home. Noureddin took Edessa 1150, Damascus 1154, making the latter his capital. His power was now so great that he was appealed to by a grand-vizir of Egypt against his enemies striving with him for the sovereign power under the Fatimide sultans of that country. Once reinstated

power, the treacherous vizir refused to carry out the terms agreed on for Noureddin's support, and calling in the help of the Christians of Jerusalem (Baldwin now being dead) he drove out the Damascus forces. Two years later Noureddin sent a great expedition, under the generals Saladin and Shiracouh, and completely conquered Egypt, 1171, proclaiming the (nominal) reinstatement of the Abbaside caliphate. Noureddin only enjoyed his new fame for two years. In May, 1173, he died, and the great Saladin succeeded him as sultan of Egypt and Syria.

NOVA CUSTUM (the Customs Act, as we should now term it, of 1303) was included in the Carta Mercatoria of that date (the Charter of Merchants), whereby the foreign merchants, in return for certain privileges, granted Edward I. an additional "new customs" of 40d. on every sack, 40d. on every 300 fleeces, and 80d. on every last of leather. The "old customs" (*antiqua custuma*), which had been settled in 1275 under the same king, gave him just double these rates, and in 1294 the "old customs" had been raised with the consent of the merchants to 5 marks on the sack, to 1 mark for every 100 fleeces, and 10 marks on the last of leather.

NOVA SCOTIA, a British colony in North America, is situated between 43° 20' and 46° N. lat., and between 59° 10' and 66° 20' W. lon. It is surrounded by the sea, except at its north western extremity, where the isthmus of Chignecto, 11 miles across, unites it to New Brunswick. On the west side of Nova Scotia is the Bay of Fundy; on the south and east the Atlantic; on the north it is divided from the island of Cape Breton by the Gut of Canso; and from Prince Edward Island by Northumberland Strait. Its coast line is about 1200 miles, and its extreme length is 350 miles, and breadth 120 miles. The area is about 21,000 square miles.

Coast, Surface, and Rivers.—Along the shores of the Atlantic, from Cape Canso to Cape Sable, the coast is rocky and rather high, though steep cliffs rarely occur; and there are many inlets which form safe harbours. The remainder of the coast exhibits an alternation of high and low ground. The central watershed of Nova Scotia extends the whole length of the province, throwing streams to the north and south. The South Mountains, in Annapolis and King's counties, form a part of this central ridge. The North Mountain rises parallel with the Bay of Fundy from Cape Blomidon to Digby Neck. The Cobequid Mountains extend through Cumberland and Colchester counties from Cape Chignecto to the borders of Pictou. The northern part of Cape Breton, from Nigonish to St. Anne's, is mountainous and much admired for its bold scenery.

The lakes are numerous, the two largest in Nova Scotia proper being 15 and 20 miles long; but in Cape Breton (which was annexed to this colony in 1819) they are more extensive, the great Bras d'Or being a large expanse of water about 50 miles long and abounding in fish. The Bay of Fundy is famous for the height and rapidity of its tides and the excellence of its shad fishery. The number of rivers is very great, but their course is short. Nearly all of them form good harbours at their mouths, and many have rapids not far from the sea, which, however, do not

prevent them from being used to float down the timber from the interior. The largest are the St. Mary's, La Have, Annapolis, Aven, Liverpool, Shubenacadie, Wallace, Philip, and East River of Pictou, Minas Basin. The most important islands on the coast are Pictou, St. Pauls, Seatarie, Cariboo, Bouladerie, Madame Sable, Tancoek, Cape Sable Island, Long Island, and Briar Island.

Climate and Productions.—The climate of Nova Scotia, although very fine, is yet peculiar. From about the middle of November till about the early part of April it is almost arctic in its severity; during January and February the thermometer often falls to 10 and 15 degrees below zero. Snow falls in abundance, and the soil is ice-bound. During May and a part of June the weather is objectionable; fogs, damp winds, and steamy weather prevail. The melting of the snow and ice causes the country to be soft and muddy, and it is then unhealthy. By the end of June fine weather sets in, and spring, then summer, rush, as it were, to make up for lost time. In an interval of a fortnight the climate changes and becomes almost tropical, the thermometer running up sometimes to above 90 degrees in the shade. The nights, however, are invariably cool and pleasant. From August to November—called the "Fall"—the weather is lovely—fine clear warm days, mild nights, and a fresh feeling that is enjoyable. The soil is very fruitful, and little manure is required. Everything grows rapidly and well, and the necessaries of life consequently are abundant. Cattle, pigs, sheep, and poultry thrive.

Annapolis County, the country of "Evangeline," is fully entitled to precedence as the best general farming and fruit-growing district of the province. The Annapolis Valley proper presents such a picture as is found nowhere else except in Devon, Kent, or some of the southern counties of England. In this charming valley, sheltered from the rude cold winds by the north-western mountains, and consequently favoured with a higher temperature than any other part of the province, Indian corn ripens and fruits grow in perfection. The Annapolis orchards are famous throughout the Atlantic sea-board. Both soil and climate are adapted to the growth of apples; peaches, pears, plums, grapes, and melons are grown in the open air. All the small fruits, such as currants, gooseberries, strawberries, raspberries, blackberries, blueberries, huckleberries, cranberries, &c., are very abundant, both in a wild state and cultivated. Hops may be profitably raised, as the climate is well adapted for the growth of the plant, and the dry, warm climate of some of the western counties would insure the early ripening of the blossoms. The forests are very extensive. Pines, spruce, hemlock, beech, and birch are among the best known woods. Nova Scotia is not in any sense an agricultural country, and so long as there is an acre of uninhabited or uncultivated prairie-land left in the Dominion it is not likely to become so. The soil in many parts, however, is very fertile, and in some of the interior counties (Hants, King's, and Annapolis especially) fine crops are raised. The best soil for farming purposes is on the northern slope. The sport for which Nova Scotia is famous is moose-shooting. This sport, however, is dying out, and before long it will probably be extinct. The moose is the largest of the deer tribe, and stands, when full grown, 17 or 18 hands high. It is a denizen of the large pine forests and swamps, and is rarely seen in the open except when alarmed and retreating. The other wild animals are bear, tiger-cat, fox, marten, otter, mink, beaver, musk-rat, porcupine, racoon, weasel, squirrel, and hare. In every lake and river trout can be caught similar to the trout in England; in some few lakes grayling also can be taken. Some years ago salmon were plentiful in every river in Nova Scotia; but although game-laws have been framed by the government of Canada for the protection of salmon, and also for the preservation of game, these laws are practically useless. The destruction of salmon is being

rapidly accomplished. The coast abounds with cod, haddock, mackerel, smelt, and other kinds of small fish. Lobsters and oysters are also plentiful.

Nova Scotia and Cape Breton are very rich in minerals. Coal and iron are abundant—the area of the productive coal-field being estimated at 700 square miles. Gold is also found. Indications of copper and lead occur along Northumberland Strait. Gypsum, salt, slate, and freestone are met with in considerable quantities. Valuable mineral oils have been found in Cape Breton.

History, Government, Commerce, &c.—Nova Scotia was discovered by Cabot in 1497, and settled by the French, who named it *Acadie*. It was finally ceded to Great Britain in 1758. It was upon Sir William Alexander, the founder of the province, that Charles II. conferred the extraordinary privilege of creating baronets. The island of Cape Breton, 100 miles long and about 80 broad—which is only separated from Nova Scotia by the Gut of Canso, $\frac{1}{2}$ to $1\frac{1}{2}$ mile broad—was a separate colony from 1781 to 1819, when it was incorporated into the province of Nova Scotia. In 1867 both were united with Canada and New Brunswick, to form the Confederation of the British Provinces in North America, full particulars of which are given in the article CANADA. The colony sends twenty-one members to the Ottawa Parliament, two each from Halifax and Cape Breton counties, and one each from the remaining sixteen. There is a lieutenant-governor appointed by the governor-general in council, and an executive council of nine, chosen from the members of the legislature. This consists of an Upper House of twenty-one members, appointed by the governor, and a Lower House of thirty-eight elected members. A supreme court is held twice a year in every county, and there is a court of equity at Halifax, besides general sessions, justices, probate, marriage and divorce, vice admiralty, and error courts. There are numerous schools and colleges in the province, the best endowed being King's College, at Windsor. The colony forms the diocese of a Church of England bishop. All the gold mines are upon crown land, or upon land where the mines and minerals have been reserved to the crown. The mines are therefore a source of provincial revenue; and stringent but liberal enactments have been passed providing for their management and for accounting for their proceeds. The colony is well provided with railway and other communication. The chief articles received from Nova Scotia are raw cotton, wood, and skins, in exchange for apparel, cotton, linen, and woollen goods, hardware, leather manufactures, and tea, from the mother country. The manufacturing industry of Nova Scotia is as yet small, but its position and resources warrant the expectation that at some future period it will occupy a first place among its neighbours, and it now owns more shipping in proportion to population than any other country in the world.

Population.—The population of Nova Scotia is of a mixed character. It consists of four distinct classes—the Indians or aborigines; the free negroes; the Acadians, descendants of the French, by whom the country was partially settled before its conquest by the English; and colonists from the United Kingdom and Germany. The Acadians are Roman Catholics; they settle together as much as possible, preserve their religion, language, and customs, and rarely intermarry with their Protestant neighbours. The total population of Nova Scotia and Cape Breton in 1881 was 440,572, composed of 220,538 males and 220,034 females. The Indians belong to the Micmac tribe. They number 2122, and are pretty evenly distributed throughout the province, Pictou and Cape Breton counties having the largest number of them. There are two reserves for them in Cape Breton county, near Sydney. HALIFAX is the capital of Nova Scotia.

NOVA ZEMBLA, a corruption of the Russian name of Novaya Zemlia ("new land"), designates an island situ-

ated in the Arctic Ocean, between $70^{\circ} 30'$ and 77° N. lat., and 52° and 69° E. lon. It is about 600 miles long, with an average width of 50 miles. Nova Zembla properly consists of several islands. The land on the western side of the island is mountainous, rising from a steep and bold shore to the height of 1000 and 2000 feet. The most elevated mountain is on the strait itself, and is 5000 feet high. The eastern shores are comparatively level, especially towards the south. The vegetation which covers some parts of the surface consists only of lichens and mosses. In warm years the island can be circumnavigated without difficulty.

Nova Zembla first became known by the voyage of Burchard (1556), but had previously been visited by the Russians. In summer its coasts are frequented by walrus hunters from Archangel, but it is nowhere permanently inhabited. Subterranean stone labyrinth of great antiquity have been discovered. In 1594 the Dutch navigator Barents was drifted helplessly by the floe-ice to the northern shores of Nova Zembla, where he and fourteen others were forced, amidst much privation and suffering, to pass the winter. In 1872 Carlsen, a Norwegian captain, touched at the spot and found the rude house Barents had constructed, with the cooking pans over the fireplace, the old Dutch clock against the wall, arms, tools, instruments, books, &c., just as they had been left 278 years before. The relics were purchased by the Dutch government, and placed in the museum at the Hague.

NOVALIS, the literary name assumed by *Friedrich von Hardenberg*, a German poet and mystic, who was born 2nd May, 1772, at the country residence of his family in the Grafschaft of Mansfeldt, Saxony. His father, the Baron von Hardenberg, the director of the Saxon salt-works, was a member of the Herrnhut communion, and his mother is described as being eminent for her piety and Christian gentleness. Friedrich was educated at Jena, Leipzig, and Wittenberg, and he devoted himself earnestly to the study of philosophy, together with the physical and natural sciences. The most powerful impulses of his academic years were those derived from his acquaintance with Fichte and Friedrich Schlegel, and he remained on terms of intimate friendship with the latter up to the end of his life. His chief works are an unfinished "psychical romance," the "Disciples at Saïs," "Hymns to the Night," some mournful but beautiful poems composed under the influence of personal sorrow, and an unfinished mystical romance, which he designed to be an apotheosis of poetry, entitled "Heinrich von Ofterdingen." He died of consumption, 19th March, 1801, in the arms of his friend Friedrich Schlegel, in his twenty-ninth year. His works were edited by his friends Tieck and Friedrich Schlegel, with a graceful and affectionate memoir of their author by the former, in 1802, and they have been several times reprinted. There is a fine paper on Novalis, with translated extracts from his writings, in Carlyle's "Miscellanies," where he is called the "German Pascal," "the ideal of an antique gymnosophist." An English translation of his "Heinrich von Ofterdingen" was published at Cambridge, United States, in 1842; and of his "Christianity in Europe," in the Catholic Series (London, 1844).

NOVARA, a city of Italy in Piedmont, situated 50 miles north-east from Turin, and 10 from the left bank of the Ticino, on the highroad from Milan to Turin. It is on the railway, 27 miles west from the former city, and had a population of 33,077 in 1882. It gives title to a bishop. Among the public buildings are—a castle, cathedral, many other churches, convents, two colleges, a large hospital, hall of commerce, market-place, theatre, gymnasium, and public library. There is a considerable trade in silk and agricultural produce, and manufactures of silk and linen fabrics, hats, and leather, are carried on. Some of the churches, convents, and the palaces of the nobility

are handsome structures. The total defeat of the Sardinian army near this town by the Austrians under Marshal Radetzky (23rd March, 1849) led to the abdication of the Sardinian king, Charles Albert, and to the renunciation on the part of Sardinia of all claim to the sovereignty of Lombardy.

NOVATIANUS, a presbyter of the Roman Church in the third century, the founder of the sect of the Novatians, was born about the beginning of the third century. Of the facts of his life very little is known, but it is asserted that before his conversion to Christianity he had been trained in the philosophy of the Stoics, and that he only accepted the new religion after a severe mental struggle, being baptized, by sprinkling only, when on a sick-bed and in homely expectation of death. He was ordained a presbyter by Fabian, the bishop of Rome, and he became distinguished as a leader of the party within the church who were in favour of the exclusion from ecclesiastical communion of all those who after baptism sacrificed to idols to escape persecution. After the martyrdom of Fabian in January, 250, Novatianus aspired to the bishopric, but in March or April, 251, the presbyters elected his rival Cornelius, who was not only milder in his views of discipline, but was also a decided episcopalist, while Novatianus clung to what was still left of the disciplinary powers of the presbyters as distinguished from the bishops. The rejection of Novatianus was a great disappointment to the party who shared his views, and they induced him to obtain episcopal ordination from some country bishops, and place himself in opposition to Cornelius. The latter promptly assembled a synod at Rome, which excommunicated Novatianus and his abettors, but this did not hinder them from gaining an extensive footing in almost all parts of the church. They claimed for themselves a character of especial purity, and took the name of Cathari or Puritans, but by their opponents they were styled Novatians. After they had become established in a separate communion, they set up rival bishops in many parts of the Roman Empire, and established a large number of churches. Converts from the Catholic Church were re-baptized, and members who fell away during persecution, or who after baptism fell into gross sin, were refused absolution, and were not permitted to remain in communion with the church. The date of the death of Novatianus is unknown, but he is said by Socrates to have suffered martyrdom under the Emperor Valerian. Of his numerous writings three have been preserved, the most important being a treatise "De Trinitate;" the others are letters, one addressed to Cyprian in 256, and the other written at the request of the Roman laity, entitled "De Cibis Judaicis." The sect founded by him long maintained a separate existence, and it can be traced as late as the end of the sixth century.

NOVEL (Ital. *novella*, from Lat. *novus*, new), a species of prose fictitious composition, distinguished from a romance by its more closely sketching real life and manners, and founding its plot, incidents, and characters on the every-day course of ordinary society; thus, "Don Quixote" is a romance, "Tom Jones" a novel. The distinction, however, is not very well defined, and fictions daily issue from the press which it would be difficult to range with precision under either classification. In Italian the earliest specimens of the *novella* are to be found in Boccaccio's "Decamerone," which were probably a model for our English writers. Defoe's novels, still excellent, were the first of real value with ourselves. But a prose fiction of entirely original character was struck out by Richardson, who founded the sentimental novel; and by Fielding, who was the creator of the satirical or humorous novel. An immortal and unique novel comes to us from Goldsmith's pen, full of quaint touches of delightful humour, and of a simplicity never surpassed—the "Vicar of Wakefield." Later on came Sir Walter Scott with his unrivalled historical novels, and Mis-

Austen, with her equally fine miniatures of society, true to a hair. In the past generation Charlotte Brontë wrote undying books. English literature has always been rich in this agreeable species of composition, and the glories of the earlier novelists have been well sustained by recent writers: by Thackeray, with his trenchant exposures of conventional falsehoods; by Dickens, with his vivid pictures of social life, his broad sketches of character, his strokes of humour, pathos, and caricature; by Bulwer Lytton, with his versatile and many-coloured genius; by Anthony Trollope, with his new photographs of our clergy and gentry; by the generous-hearted apostle of the persecuted, the unflinching realist, Charles Reade; and by George Eliot, a writer whom we fondly hope immortal, whose books are transcripts of the manners and modes of thought and currents of feeling of our own time. Even among living novelists many great names happily abound. The novel, for the moment, outbids both stage and pulpit as the public teacher; and no matter what a man has to say, he will get listened to if he but throw his thoughts into this attractive form.

In France a really fine style of novel-writing, supplanting the interminable novels of Mlle. de Scudéry, though still much too long and diffuse for modern taste, was inaugurated as early as the end of the seventeenth century, by the "Princesse de Clèves" of Madame de la Fayette, the friend of Rochefoucauld, and was pursued with equal success by a greater, though less natural writer, Marivaux ("Vie de Marianne," &c.) A little later comes the Abbé Prevot (died 1763), with the immortal "Manon Lescaut." Excellent as this novel was, it was deservedly eclipsed by "Gil Blas," which, with "Le Diable Boiteux" and some others, has immortalized the name of Le Sage. Crébillon would have been a great novelist if his moral tone were not so coarse. He is now unreadable. Rousseau ("Julie," "Emile"), Voltaire ("Candide," "Zadig," &c.), Diderot ("Jacques le Fataliste," "La Religieuse," &c.), and others of that time of ferment used the novel as a means of expression, and the works named, though all books "with a purpose," are at the same time good from a story-telling aspect. Under the Revolution and Napoleon I. novels were at a discount. Victor Hugo ("Notre Dame," "Les Misérables," &c.) revived it in a highly romantic and poetical form, a type followed successfully by Georges Sand, Alexandre Dumas meanwhile pouring forth a countless flood of exciting historical and adventurous tales, and De Balzac giving out a long series of novels unequalled in insight into every variety of character. The last writer has done magnificent service to all time by leaving complete pictures of all classes under the Restoration in France. He rightly called the whole long series "La Comédie Humaine." Saintine deserves mention for his exquisite "Picciola," and Erckmann and Chatrian for their marvellously vivid and accurate war stories of Alsace under the First Empire, &c.

In Germany, Goethe, Richter, Musäus, Tieck, and Fouquet are the leading names of the last generation, and Auerbach and Freitag of the present.

In France a repulsive school of realistic novelists has lately grown up, who relieve their dullness by the spice of the lowest immorality, barely set forth in all its shocking nakedness. Perhaps this school may be said to have had its origin in the minute and life-like work of a great genius, Flaubert ("Mad. Bovary," "Salammbo," &c.), but in such novels as Flaubert's realism is but one of many elements, and not even the chief among them.

On the other hand, Messrs. James and Howells and their school have originated in America a style of novel very pure and quiet in incident, very diffuse in detail, psychological studies rather than tales, which seems almost a translation into our own century of Miss Austen's miniature paintings (*quantum mutatus ab illa*), and which represents the opposite pole to the prurience of Paris.

NOVEL DISSEISIN. The *Assize of Norel Disseisin* was one of the ancient feudal law processes, whereby a writ was issued to the sheriff at the request of the person *disseised*, or dispossessed of land, commanding him to summon a jury to decide upon the lawfulness of the act. The procedure is regulated in the *Assize of Northampton* (temp. Henry II., 1176). Magna Carta, in clause 18, orders this assize to be taken four times a year by two justices and four knights elected by the county, which was reduced to once a year in 1217. By the statutes of Merton (1236), of Marlborough (1267), of Westminster (1285), the abuses of these procedures, as "frequent and vexatious disseisins," were sought to be delayed. The process was so expensive that the extraordinary legal fiction, now happily obsolete, of the proverbial John Doe and Richard Roe [see DOE], who fought out an imaginary battle on a side issue, was invented to avoid it. The writ of novel disseisin could, however, be issued down to as late as 1833, when it was abolished. The fictitious Doe and Roe lasted even nineteen years longer, till 1852.

NOVELLO, VINCENT, composer, editor, and publisher of music, was born in London in 1781. His father was Italian, but his mother was English. He studied music under Webbe, the famous glee-writer, and became his deputy organist at the Sardinian Chapel while yet a boy. In 1797 he was appointed organist of the Portuguese Chapel. He was one of the founders of the Philharmonic Society. He went to Nice in 1849, and died there in 1861. His own writing, principally for the church, is very refined and pleasing; but his great title to our gratitude is as a collector, arranger, and editor of early church music, such as that by Pucell, Greene, Boyce, and Croft, of the finest foreign church music, as the masses of Mozart, Haydn, Beethoven, &c., as well as the "Psalmist," and other fine collections of chants and hymns. Before Novello's time good music was very dear and difficult to procure. He was honoured by the close friendship of Mendelssohn. His beneficent work as a publisher of cheap classical music was continued by his son, J. A. Novello.

CLARA NOVELLO, one of the finest singers (soprano) England has ever produced, was the daughter of Vincent Novello. In 1837 (when only nineteen) she sang for Mendelssohn at Leipzig, and passed onwards through most of the chief continental towns, exciting unbounded admiration. She appeared in opera first in Padua, 1841, and in London in 1843, winning her greatest English triumphs, however, in oratorio. On her marriage to Count Gigliucci, at the end of 1843, she retired, but resumed her profession in 1850. At the Crystal Palace in 1851, and at the two first Handel Festivals (1857 and 1859), she sang in a manner which has become a tradition of beauty and power. She retired in 1860, while yet at the summit of her renown.

NOVELS or **NOVELLÆ** form a part of JUSTINIAN'S LEGISLATION.

NOVEMBER, the eleventh month of the Julian year, was the ninth in the year of Romulus, whence it received its name (Lat. *novem*). It originally consisted of thirty days, which were continued by Romulus and Numa. Julius Cæsar gave it another day, but Augustus reduced it again to thirty, and this number it has ever since retained.

Our ancestors called November *Slaughter-month* (slaughter-month), *Blotmonth* (blood month), the month of sacrifice, because at this season they made a provision for winter, and offered in sacrifice many of the animals which were then killed. Another name was *Windmonth*, because of the storms, boatwork and fishing ceasing for the year. The French republicain name was *Brumaire* (Fr. *brume*, fog).

NOVERRE, JEAN GEORGES (1727-1810), was the inventor of the modern form of the BALLET. He was born in Paris, the son of an old soldier of Charles XII.; but his love of dancing led him to refuse his father's pro-

fession of arms. He studied dancing under Dupré, and appeared before the court in 1743. He gained such fame that Garrick invited him to London in 1755. His first published ballets (that is, the *scenario* or *libretto*, which the ballerini enact by dancing and pantomime) appeared at Lyons in 1758. His famous work, the "Letters on the Dance and the Ballet," also appeared at Lyons in 1760, and at once attracted notice. All the rest of his life he was improving and remodelling this work, which is the classic on the all important subject of which it treats; and in his projected "Dictionary of Dancing," which, however, never came to completion, Noverre raised the ballet to the dignity of a work of expressive art. He served in succession the Grand-duke of Wurtemberg, for whom he wrote twenty ballets; the Empress Maria Theresa; and lastly, in 1775, Marie Antoinette of France. Mozart wrote twelve movements for one of Noverre's Paris ballets. Noverre fled to London in 1789 on the outbreak of the Revolution, and was reduced to great poverty, as the competence he had amassed in so long and laborious a career was all swept away. He wrote some of his best ballets for the London stage, and returned to France under the Consulate.

NOVGOROD, a town of Russia, and the capital of a government of the same name, is situated on the banks of the Wolchow, 100 miles S.S.E. of St. Petersburg. The city consists of three parts: the fortress, standing on a steep hill on the north side of the river, surrounded with thick walls and towers; and on the south of the river the commercial town and the Sophienstadt (St. Sophia's Town), which are connected with the fortress by a handsome stone bridge. This city is one of the most ancient in the Russian Empire, but its importance was diminished when St. Petersburg was selected as the imperial capital. It consists principally of scattered groups of mean houses, separated by ruins or by fields formerly built upon, and its population at the last census was only 18,000, though it is said to have amounted to 400,000 in the fifteenth century. At this period Novgorod, with Lodon, Bergen, and Bruges, constituted the four principal foreign depots of the Hanseatic League; but the fall of the League, and still more the massacres perpetrated by Ivan Vassilievitch II., in 1570, proved fatal to this great emporium; and it soon after fell into all but irremediable decay. The principal church is the cathedral, dedicated to St. Sophia; there are upwards of sixty other churches. The other buildings comprise an archiepiscopal palace, numerous nunneries and monasteries, a fine bazaar, a palace, a poorhouse, and an orphan school. There are several elementary schools and a Bible Society, a considerable sailcloth manufactory, tanneries, and vinegar, soap, and candle manufactories.

Novgorod is the cradle of Russian history. In 862 the Norman Prince Rurik, of the tribe of Variago-Russ (from which the word Russia is derived), was invited hither by the neighbouring tribes, and from him begins the history of the country and the line of its sovereigns. A monument, commemorative of this event, was erected here with great pomp on the thousandth anniversary, in September, 1862.

NOVICE (Lat. *novitius*, new), the appellation given in the early church to a newly baptized person, and afterwards applied to a catechumen, but which is now given to persons of either sex who are living in a religious community in a state of probation previous to becoming professed members. The period of the novitiate must not be less than one year, and the person who enters as a novice must have attained the age of sixteen. The Council of Trent, session 25, can. 17, prescribed that female novices, after the expiration of their novitiate, should return to their friends, and be examined by the bishop of the diocese, in order to ascertain that they were under no constraint or deception, and that they voluntarily chose to enter the monastic life. These precautions, however, have been neglected in many instances.

NOVUM ORGANON. See BACON, LORD.

NO'WELL. See NOEL.

NOX. See NUX.

NOYADES (from Fr. *noyer*, to drown), terrible wholesale executions by drowning, arranged during the Terror in the French Revolution by the brutal Carrier, at Nantes. The victims were bound and carried out at night in the winter into the midst of the Loire by barge-loads; then the barges were scuttled, and the whole of their living helpless freight plunged into the ice-cold river. The first noyade was of ninety priests, the second (14th December, 1793), was of 138 persons, men and women. Soldiers with loaded muskets were ready to shoot any hopeful struggler, while ruffians stripped the victims of their clothes. Later on these horrible deeds were done by daylight; and five and twenty noyades in all are reckoned.

NO'YAU, or CRÈME DE NOYAU, a favourite liqueur prepared by flavouring sweetened spirit with bruised bitter almonds, essence of bitter almonds, or bruised apricot or peach kernels. It owes its characteristic nutty flavour to the presence of a minute proportion of the essential oil of bitter almonds. As this always contains a portion of prussic acid it is evident that the liqueur is best taken in small quantities. In some cases, other flavouring ingredients, such as orange-flower water, essence of lemons, &c., are added.

NUBEC'ULÆ. See MAGELLANIC CLOUDS.

NU'BIA, a general and rather vague denomination, which is often used to designate a vast extent of country stretching along the banks of the Nile from the southern borders of Egypt to the frontiers of Abyssinia and Sennaar. The extent of information possessed by the ancients concerning those regions is stated under ÆTHIOPIA.

The Nubæ, or Nubatæ, are mentioned as a nation bordering on Egypt in the time of Diocletian. In subsequent centuries, however, a kingdom of the Noubas was formed, of which Dongola was the capital. The country appears to have continued to profess Christianity, and to have retained its independence till the thirteenth century of our era. Soon after the invasion of Egypt by the Caliph Omar, a Saracen army advanced to Dongola, and obliged Koleydozo, the king of the Noubas, to agree to pay an annual *hekt* or tribute of 360 head of slaves. This agreement was maintained with little interruption for more than five centuries. During the fourteenth century repeated contests took place between the kings of Nubia and the sultans of Egypt. After that time little is known of the history of Nubia; but it seems that the power of the kings of Dongola being broken, the country became divided into various petty states, while fresh immigrations of Bedouin Arabs took place, and Christianity became gradually extinct in all the countries between Egypt and Abyssinia.

Nubia is circuitously traversed by the river Nile, which forms five cataracts within its limits, receives its principal tributary, the Atbara or Taccæze, and is fully formed near Khartoum by the junction of its two main branches, the Blue and White Niles. Lower Nubia, the northern portion, apart from the inundations of the Nile, is a dry, burning, and sterile wilderness of rocks, shingle, and sand. But the upper or southern part of the country has a totally different character, being within the range of the tropical rains. The surface is largely clothed with mimosa forests, parasitical plants, and arborescent grasses, and the country is remarkable for an extraordinary number of wild animals, including elephants, hyænas, antelopes, with the rhinoceros, lion, and giraffe, the crocodile and hippopotami. The inhabitants are of mixed descent, and are a muscular, finely-moulded, dark-complexioned race. Many of them have the peculiar style of countenance which is seen in the sculptures of the Egyptian temples. Polygamy is general. They are nearly all Mohammedans. Their houses are low huts of mud or stone. The climate is very healthy. The

principal articles cultivated are durra, maize, and dates, for food, besides some cotton and tobacco, which with natural products of the soil, as sesam, myrrh, and frankincense, are sent into Egypt, together with hides, ivory, ebony, and ostrich feathers. There is no native currency, and the coins of Europe and Egypt are received, but glass beads, coral, cloth, and other articles pass in exchange. Many Arab tribes inhabit the territory of Shendy, the great part of whom still lead the Bedouin life. The merchants of the town, and especially the brokers, are mostly foreign settlers from Dongola, Sennaar, Darfur, and Kordofan. Not far from eastern Shendy, to the northwards, near a village called Assour, or Hatchour, are a number of *tarabyls* or pyramids, the largest of which is about 60 feet high; and there are in various parts of the country numerous other remains of antiquity. The chief town in the south is KHARTOUM.

NU'CIN, a yellow colouring matter contained in the green shells of the walnut (*Juglans regia*, natural order Juglandaceæ). It crystallizes in minute needles, and sublimes at 100° C. (212° Fahr.) unchanged. It is insoluble in water, slightly soluble in alcohol, very soluble in ether. It is not nitrogenous. It gives a splendid red colour with alkalies, in which it is soluble, the solution being precipitated by an acid.

NU'CLEOBANCHIA'TA. See HETEROPODA.

NU'CULEUS, in botany, is a term applied to that portion of the OVULE (or immature seed) included within the integument. It is also applied to a denser portion of the protoplasm in the cells of all plants except some Thallophytes. It is always clearly marked off from the surrounding protoplasm, and is sometimes round, sometimes lenticular in shape. Its position is generally close to the cell wall, but it is sometimes found in the centre connected with the walls by threads of protoplasm, e.g. in the calyx hairs of Spider-wort (*Tradescantia*). In the young state of the cell the nucleus has a large relative size, but it does not increase much, while the cell keeps growing. The external layer becomes membranous, while an inner portion becomes marked off as a nucleolus (or small nucleus). The movement of the nucleus may be a passive one, carried about by the motion of the protoplasm, or it may have an independent amoeboid motion of its own.

Its composition is a modification of the protoplasm of the cell, out of which it is differentiated. But it has special properties, such as taking up certain colouring matters, while the ordinary protoplasm remains entirely or only feebly coloured. There is generally only one nucleus in each cell, but sometimes there are several. When a cell is about to divide into two cells, the nucleus first divides; the two parts separate, connected at first by threads of nuclear matter, and finally a cell-wall is formed between them.

NUG'GET, a lump of gold found in its native bed or among the debris of the primitive rocks in which it was produced. It was originally spelt *niggot*, which was probably a corruption of *ingot*. Very large nuggets have been found in the Australian gold-diggings. One discovered at Ballarat, weighing no less than 184 lbs., was estimated to have a value of over £8376. There is a cast of this specimen in the Natural History Museum at South Kensington.

NUISANCE is a term derived immediately from the French *nuisance*, and ultimately from the Latin *nocere*, to hurt. Two kinds of nuisance are recognized in English law: (a) *common or public nuisances*, which interfere with the public generally; and (b) *private nuisances*, which injure individuals. A public or common nuisance has been defined by Mr. Justice Stephen as "an act not warranted by law, or an omission to discharge a legal duty, which act or omission obstructs or causes inconvenience or damage to the public in the exercise of rights common to all her

Majesty's subjects." Against many forms of public nuisance provision has been made by statute, and where this is not the case they are punishable as misdemeanours at common law. Among common nuisances are the obstruction of highways or public footpaths; and annoyances in highways, public bridges, or navigable rivers, which are produced by rendering the passage inconvenient or dangerous, either positively by actual injury, or negatively by omitting to repair in cases where the law imposes the duty of repairing. Other examples may be found in the carrying on of noxious or offensive processes of trade or manufacture in towns, or the keeping of disorderly houses. The remedy for a public nuisance is by information, indictment, summary procedure, or abatement. In some instances the law recognizes the right on the part of the persons injured to "abate" the nuisance without calling for legal assistance. Thus if a public path be obstructed by the throwing of a gate across it, any person may peaceably remove the obstruction, reasonable care being used to do no more damage than necessary.

A private nuisance is an annoyance which affects individuals only, and its remedy is by mandamus, injunction, action for damages, or abatement. Where an action is brought to recover damages, and they are granted by the court, the nuisance is not necessarily removed. But every continuance of a nuisance is held to be a fresh one; and therefore a fresh action will lie, if after a verdict has been obtained the nuisance is continued. An action lies in every case for a private nuisance; and where a private person suffers special damage from a public nuisance, he has also a right to an action. A private nuisance is caused by a man erecting a building which overhangs the house or land of his neighbour, or which obstructs his ancient lights, or which throws an undue amount of rain water upon his house or land. A man may also become responsible for a nuisance if he carries on an offensive business, so as to render the dwelling-houses of his neighbours uninhabitable; or if he constructs a cesspool which contaminates his neighbour's spring or land; or by his turning or letting impure drainage run into a water-course or pond. A private nuisance may be in some cases legalized by an uninterrupted use for twenty years, as in the case of noisy or noxious trades; but no length of time will legalize a public or common nuisance. In Scotch law the distinction between public and private nuisances is unknown. The law as to what constitutes a nuisance, however, is substantially the same as in England. In Scotland what would not amount to nuisance at common law is often raised into that category by statute. See in particular the Public Health Act, 1867 (30 & 31 Vict. c. 101). See also Smoke Nuisance Acts (20 & 21 Vict. c. 73; 24 & 25 Vict. c. 17; 28 & 29 Vict. c. 102); and the general Police Act of 1862.

NUMA POMPILIUS, the second King of Rome, was a native of the Sabine town of Cures. On the death of Romulus the Roman senate seized upon the government, but after about a year the Sabines succeeded in compelling their antagonists to receive Numa Pompilius as king, and he soon made himself revered by all for his wisdom and knowledge. Instructed by the Camena, or nymph, Egeria, as it was given out, whom he met secretly in a grove near the Palatine, he founded the whole system of the Roman religion; he increased the number of augurs, regulated the duties of the pontifices, and appointed the flamines, the vestal virgins, and the Salii.

During his reign, which lasted thirty-nine years, no war was waged; the gates of Janus were shut, and a temple was built to Faith. He died of gradual decay, in a good old age, and was buried under the hill Janiculum; and near him, in a separate tomb, were interred the books of his laws and ordinances. These books were said to have been discovered B.C. 181. This was of course a forgery, but it created much stir in Rome at the time.

NUMBER. The perception of number is one of the earliest to arise in the mind. At first the infant perceives only the difference between something and nothing, and is not conscious of that between the one and the many. But as touch-perceptions become more clear, he can distinguish between the continuous sensation as his hand feels over the one large surface of the table, and the broken sensations as it passes over a row of toy bricks, or of any other objects. By twenty-two to twenty-four months old he clearly distinguishes between one and more-than-one; but the subdivision of "many" into "how many" takes some years more. The eye also, yielding from muscular sources the same elements of continuity or discontinuity as its line of sight passes over even or over broken surfaces, is guided and helped at first by the sensations of manual touch. The visual perception of number is derived from touch and from the muscular feelings of the eye in the first instance, these two bringing gradually to perfection the perceptive power of the retina. We can perceive four coins lying close together at one glance; but this is the result of repeated tactile and muscular perceptions of four widely separated objects in early infancy, which after a long process of very gradual growth enable us finally to form a mental concept of four, and therefore now to see it and count it, though the eye does not move nor the hand touch. And even in persons of maturer years, the best way to train the eye to perceive number readily is to accustom it to group objects under certain forms, as when we recognize a heap of eleven coins as two groups of six and five respectively. Into such "number pictures," the most familiar example of which is a pack of cards, the muscular element of sight enters very largely. Our ideas of numbers as soon as they pass the limits of a group easily seen at one glance of the eye, are of the vaguest nature. Twenty men will give twenty different estimates of the numbers in a large crowd, if speaking on the spur of the moment; though all will agree upon the same result if time be given to divide the crowd into lines or groups, &c. Our idea of the distance of the sun is simply a summation of ideas of one mile, and of multiples of that idea of a mile in the form of long railway journeys and the like. In the last resort our conceptions of number will all be easily found to repose on something picturable to the eye; and these pictures are found, when analyzed, to be, as we have shown, the outcome of touch-sensations in long forgotten processes of thought—processes which we can only reconstruct by observing them as they occur in our infants.

The notion of number is suggested by repetition or succession; and it is customary to call the actual things repeated, considered as a collection, a concrete number, while the notion formed from comparing the collection with one of the things collected is called an *abstract* number. This abstract number arises from repetition of objects, in which the attention is directed to the repetitions as repetitions, and not to the objects as distinguished from other objects. It is therefore a number of times, not of things.

If we never numbered any things capable of division into parts like themselves, our notion of number would rest in what is now called *whole* number. If the intellect were taught to count by the beating of a clock, and never came in contact with any other magnitude except that of the intervals between the beats, it is difficult to see how the idea of fractions would be obtained. But when we come to put together continuous magnitudes, which might increase or decrease without any alteration except that of magnitude, such as lines, surfaces, &c., we then begin to see that the unit is purely arbitrary, considered as a magnitude, so that the consideration of smaller or larger units, and the reduction of processes from one unit to another, become necessary. Hence the doctrine of fractions and of incommensurables.

The unit of magnitude and the unit of repetition are as distinct as concrete and abstract number. A given magnitude being chosen, we may fix our own ideas of other magnitudes and convey them to other persons by describing the repetitions of the given unit, which will severally give the other magnitudes: but it is incorrect to say that in arithmetic we can operate upon magnitudes represented by numbers; the operations are performed by our minds upon notions of repetition, not of magnitude. Any question of numbers arising out of geometry might, so far as the pure arithmetical processes are concerned, as well have the prototypes of its numbers in collections of beads of a clock or motions of the arm, as in repetitions of lengths or areas. It is not true that such simple successions would suggest as many problems as geometry or commercial business; but that is a distinct consideration. In mathematical language, every numerical symbol is called number, including 0, 1, fractions, whole numbers, and even infinity.

Number in Philosophy; the Pythagoreans.—All through the Greek classics we find references and allusions to the number-philosophy of Pythagoras, who taught in the latter half of the sixth century B.C. Aischylos, the great dramatist, a Pythagorean, makes his Prometheus boast that he had discovered for men "number, the highest of the sciences." But these references and allusions most unfortunately become vaguer, though not less frequent, as we near the time of the great sage himself, and from his own hand we have not a word. It is therefore impossible now fully to reconstruct the Pythagorean number-philosophy; but it is by no means impossible to indicate its main lines, and that, too, with accuracy and certainty.

The ancients directed their highest efforts in pure thought towards the discovery of an *Archê*, a first principle underlying and causing that unity of nature which struck them with admiration as it strikes us to-day. Pythagoras, among whose followers were the greatest names of the Greeks in mathematics and astronomy, Archytas, Philolaos, and later on Hipparchos and Ptolemaios (Ptolemy), thought he had discovered this *Archê* in the dictum preserved to us by Aristotle, that *Numbers are the principles of all things*, or, as otherwise expressed, "Things are but the copies of numbers," and elsewhere, "Numbers are the cause of the material existence of all things." What is quite certain now, as then, is that number is the residuum of a destructive analysis of the nature of anything. Take away mentally every attribute, and it is still something; formless as it is, it remains *one*. This number, therefore, is the highest expression of deity, of infinity of existence, and as all things come from the gods, so the expression of all things comes from the number *one*. One is the *Archê*. This is a specimen of the nature of the Pythagorean speculation; and as a poetical or symbolical conception it has undeniable elements of truth and beauty. Unfortunately this, the popular view, is totally inaccurate, as we know definitely from Aristotle ("Metaphysics," I. 5), for nothing can be clearer than his exposition of the actual (as opposed to symbolical) nature of this curious teaching. Aristotle says that Pythagoreans definitely taught that "a certain combination of numbers was justice, a certain other combination was reason, another was opportunity, and so on. Moreover they discovered in numbers the basis of music, . . . and from all this they concluded that numbers are the elements of things, and the whole heaven is a musical harmony and a number. . . . Thus, since *ten* appeared to them a perfect number, potentially containing all numbers, they declared the planets to be ten in number, and since they could only see nine they taught that a tenth must exist, the *Antichthôn* or counter-earth" (which by its position beneath the earth was invisible). Aristotle expressly says the doctrines would have been rational enough if they had been symbolical.

Properties of Numbers.—Various names have been

given to classes of numbers, each expressive of properties common to all in its class: they are pointed out in the following list:—

The whole scale, 1, 2, 3, &c., is called that of *natural* numbers; it is subdivided into the scale of *odd* numbers, 1, 3, 5, &c., and *even* numbers, 2, 4, 6, &c. These again are subdivided into *oddly odd* numbers, 3, 7, 11, &c.; *evenly odd* numbers, 1, 5, 9, &c.; *oddly even* numbers, 2, 6, 10, &c.; and *evenly even* numbers, 4, 8, 12, &c. When 0 is included in the list, it is considered as divisible without remainder by every number.

It is evident that 2 is the only prime even number, but there are many prime odd numbers. As regards odd and even numbers when they appear mixed or similar in the various operations of arithmetic, we find that likes (all odd or all even) give even results in addition and subtraction, and that products in multiplication are always even unless both factors are odd. In division, when there is no remainder, odd divided by odd yields odd, even divided by even yields either even or odd, even divided by odd yields even. Odd is not divisible by even without remainder.

The division of numbers into *square* numbers, 1, 4, 9, 16, &c.; *cube* numbers, 1, 8, 27, 64, &c.; *fourth powers*, 1, 16, 81, 256, &c., and so on, may be carried to any extent.

A *prime* number is any one of the list 1, 2, 3, 5, 7, 11, 13, &c., no one of which is divisible by any number except unity and itself. A *composite* number is any one which is not prime. If one number measure two other numbers, it will also measure their sum and their difference; but if it measure one only of the two numbers, it will not measure either their sum nor their difference. If it measure neither of two numbers, it may or may not measure their sum or their difference, according to the particular case chosen: there is no general rule.

A *figurate* number is any one from the following series, the first row excepted, which is only introduced as a basis.

	— 3 —	— 6 &c. —
I.	6	10 15 21 &c.
II.	10	20 35 56 &c.
III.	15	70 126 &c.
IV.	21	126 252 &c.
V.	28	210 462 &c.
&c.	&c.	&c.

Each number is the sum of the numbers in the preceding row: thus 84 is the sum of 1, 6, 21, and 56, and 84 is the fourth number of the fifth order of figurate numbers.

Other curiosities of number are these:—The product of any two consecutive numbers is divisible by 2 (1.2), of any three consecutive numbers by 6 (1.2.3), of any four consecutive numbers by 24 (1.2.3.4), and so on for all groups of consecutive numbers, and by any of the factors of the numbers named. Thus $5 \times 6 \times 7 \times 8$ (1680) is divisible by 24, by 12, by 8, by 6, by 4, by 3, by 2, by $1\frac{1}{2}$, and by 1. Hence the difference between a number and its cube (which is always the product of three consecutive numbers) is always divisible by 6 or by 3. Thus 3^3 (or 27) $- 3 = 24$, which is 6.4 or 3.8.

Any prime number divisible by 4 with remainder 1 is always the sum of two squares. Thus $269 = 1.67 + 1 = 13^2 + 10^2$. The difference of the squares of any two odd numbers is always divisible by 8. Thus $13^2 - 9^2 = 169 - 81 = 88$, or 8 times 11. The sum of any number of terms of the series of odd numbers, beginning from 1, is a square number, and if five terms be taken the square of 5 will be the sum; if seven terms, the square of 7, &c. Thus $1 + 3 + 5 + 7 + 9 + 11 + 13 = 49 = 7^2$, and it is observed that seven terms were taken. Further, the sum of the cubes of any number of terms of the series 1, 2, 3, 4, &c., is always equal to the square of the sum of the numbers. Thus $1^3 + 2^3 + 3^3 + 4^3 + 5^3 = 225 = (1 + 2 + 3 + 4 + 5)^2$.

Curious and deeply interesting cases of other properties of special numbers are found under the article **DIVISIBILITY OF NUMBERS**; and arising from the particulars there stated the following rules are manifest:—Every number is divisible

- By 2, deducting the units figure.
 “ 3, “ the sum of the digits.
 “ 4, “ the tens and units figures.
 “ 5, “ the units figure.
 “ 8, “ the three last figures.
 “ 9, “ the sum of the digits.
 “ 10, “ the units figure.
 “ 11, “ the sum of the two series of alternate digits, beginning at the units figure and at the tens figure respectively, and counting the first as units, the second as tens.

It is evident from this table that rapid and fairly efficient tests can be applied to the results of calculations; but it also appears that 2, 5, and 10 would test only the correctness of the last figure, 4 of the last two, 8 of the last three. Accordingly 9 and 11 are the favourite tests. Adding the digits of any number, *casting out nines* as we go, we get at the end either its remainder, when divided by 9, or no remainder at all; and in the latter case the number is evenly divisible by 9. Now, if we cast out nines from the various rows of an addition sum and add the remainders, the result (casting out nines, if need be) ought to equal the result obtained by casting out nines from the final sum obtained by the full working. In the same way we test subtraction by casting out nines from all three lines, when the remainder of the top line ought to equal the remainders of the other two lines together, after casting out nines if necessary. For multiplication we cast out nines from the two factors and multiply the remainders, casting out nines from the result; the remainder should be the same with that obtained by casting out nines from the product obtained by the ordinary working. For division we cast out nines from the divisor and from the quotient, multiply the results, and add the remainder, if any were obtained as we were working the sum in the usual way. This, after casting out nines, should agree with the result of casting out nines from the dividend. If in any of these cases the various results do *not* agree, then the working is wrong and must be gone over again. (A property of the number 9, which is, in fact, another aspect of what has just been exemplified, is remarkable enough to call for notice. In any multiple of this figure the sum of the digits is always either 9 or a multiple of 9; that is, by continually adding up the digits of the successive sums we always arrive at 9. For instance, in 76512687, which is a multiple of 9, the sum of the digits is 45, and the sum of the digits of 45 is 9.)

The test by *casting out elevens* is applied in the same way as that by casting out nines, but the mode of casting out is not so simple. To cast out elevens from 1654283, for example, we may say, $3+2=5$, $+5=10$, $+1=11$; then $80+10=120$, $+60=180$; then adding the two together, $11+180=191$, which, divided by 11, gives a remainder 4. It will be found that the original number divided by 11 gives also that remainder. But a quicker way is to carry over the tens when passing from the first series to the second, as thus (using the same example), $3+2=5$, $+5=10$, $+1=11$ (put down 1 and carry 1), $1+8=9$, $+4=13$, $+6=19$ (i.e. 190); result, 191. Another method of casting out elevens is by subtracting from the *left*, digit by digit, and where a greater number has to be taken from a less adding eleven to the less. Thus, still using the same number (1654283), we might say 1 from 6=5, from 5=0, 4 from 13 ($2+11$)=9, from 19=10, from 14=4. The number is divisible by 11; remainder, 4.

Comparing the two tests we see that the nines test must

be efficacious, unless there be an error in the workings of exactly 9, or of exactly a multiple of 9, and the elevens test must be accurate, if there be no error of 11, or of a multiple of 11. If, now, a sum be tested by both nines and elevens, only an error of 99, or of some multiple of 99, could escape. The combined test may therefore be regarded as practically infallible. Of the two the elevens test is the superior, because it often reveals an error of displacement. Thus, let the question be, “Multiply 64521 by 107,” and let the student multiply it by 17 in error; it will be found that the nines test fails to detect the error (as it is one of 90), but that the elevens test gives different results in the two cases.

To the examples given in divisibility of numbers may be added the following ingenious method of testing the divisibility of any number by the prime numbers, 7, 11, and 13; therefore (since these are primes) by 77 when the number is divisible without remainder by 7 and 11, by 91 when it is so divisible by 7 and 13, by 143 when it is so divisible by 11 and 13, and by 1001 when it is so divisible by all three, 7, 11, and 13. This consists in marking off the number in periods of threes, as in ordinary numeration, and then setting the right-hand period beneath the next and subtracting it, then subtracting the next period, and so on towards the left. The last subtrahend will probably be greater than the minuend, and in this case we must subtract *downward*. If 1 has been “borrowed,” the subtrahend (now to be used as a minuend) must have 1 added to it in the units place, as in the following example:—

Examine 8,026,518,123 as to its divisibility by 7, 11, 13, 77, 91, 143, and 1001.

8	026	518	423
931	095	423	

924

The answer is that 7, 11, and 77, as they will divide without remainder 924, the “test number” produced by this method will also divide the original number without remainder; that division by 13 will leave a remainder 1, division by 91 a remainder 14, division by 1001 a remainder 924, when applied to the original number, just as they do for the test number. If the test number be 0 (as, for instance, it would have been in the above example if the last period had been 952 instead of 8—931 being read as 932, in the lower row, for reasons given), then the original number is divisible by all the numbers named, from 7 to 1001. In the present case, altering 8 to 932 as proposed, 932,026,518,423 would be such a number.

NUMBERS, BOOK OF (Heb. *wayedabber*, and he spake, or *benidbar*, in the wilderness), the fourth of the books of the Pentateuch, derives its name in the Septuagint and the Vulgate (whence we take it) from the double numbering or census of the people it records. Its contents are very multifarious, and its history extends over a period of thirty-eight years and nine months; but the following are the principal divisions:—(1) Preparations for breaking up the camp at Sinai and marching towards Canaan (i.-x. 10); (2) the journey from Sinai to the borders of Canaan, and the defeat of the people by the Canaanites (x. 11-xiv. 45); (3) a brief notice of laws given and events which transpired during the thirty-seven years of subsequent wandering (xvi. 1-xix. 22); (4) the history of the last year from the second arrival of the Israelites in Kadesh till they reach “the plains of Moab by Jordan, near Jericho” (xx. 1-xxxvi. 13). Chapter xv., which has been omitted from this epitome, has no reference to time or place, and, with the exception of the section ver. 32-36, it consists of laws relating to sacrifices and garments.

Certain portions of this book (xxxiii. 2; xxxvi. 13) are expressly assigned to Moses, and the traditional view, with

scarcely a dissentient, ascribes the whole of it to him. In modern times, however, this view has been directly challenged, and the compilation of the book of Numbers, in common with the remainder of the books of the Pentateuch, has been assigned to a much later date. This controversy will be more appropriately referred to under *PENTATEUCH*, and it will only be necessary to mention here that whatever may be the final result of modern criticism, it is already admitted by the most conservative scholars that the traditional view must be largely modified, if it is to be retained at all. No one would now contend that the book in its present form, or that the whole of its contents, can be attributed to the Mosaic period; but it is also evident that some portions of it are of very great antiquity, and may be reasonably ascribed to the period of the wilderness journey.

Among the reasons assigned for the theory of a composite authorship the following are the more especially prominent:—(1) Sundry repetitions of narratives already given in the book of Exodus, such as the gift of water from the rock (Exod. xvii. 1-7; Num. xx. 1-13); the sending of the quails (Exod. xvi. 12, 13; Num. xi.); and the sign of the cloud over the tabernacle (Exod. xl. 34-38; Num. ix. 15-23). (2) The manner in which some of the events recorded are referred to—as, for instance, in the story given Num. xv. 32-36. (3) The quotation given Num. xxi. 14 from a book which can hardly have been written at so early a period. (4) Certain discrepancies in the laws enacted when these are compared with other portions of the Pentateuch or with repetitions in the book itself; compare Num. iv. 47; viii. 24; xviii. 21; Deut. xiv. 28, 29. (5) The gap in the chronology of thirty-eight years which occurs without any intimation in xx. xxii. 29, as we see from xxxiii. 38. (6) The evidences of a disjointed chronology afforded in the book; compare the interposition into the narrative of xv. and dates given i. 1 and ix. 1. (7) The use of names of places, &c., which were not adopted until a later period. Compare Num. xiv. 45 with xxi. 1-3 and Judges i. 17, and Num. xxxii. 41 with Judges x. 3-5. The episode of Balaam, also, from its style, language, and matter, is by most critics assigned to a much later period in Jewish history than the time of the wilderness sojourn. (See Bleek's "Introduction to the Old Testament," English translation, 1869.)

NUMBERS, THEORY OF. The theory of numbers is, in fact, the science of whole or integer numbers, and its most general problem is—"Given any equation whatsoever involving two or more unknown quantities, or any number of equations between a greater number of unknown quantities, to determine every possible solution in which the values of the unknown letters are whole numbers." It may also be considered that the science extends to the determination of all solutions which contain nothing but rational or commensurable fractions, all surd quantities or incommensurables being excluded. The most practical and best known application of the theory of numbers is the solution of *INDETERMINATE EQUATIONS*. Connected with the science before us is a very large quantity of properties of numbers, of which it must be said that they can be proved easily enough, but cannot be explained.

The theory of numbers is not of so much immediate practical utility in the applications of mathematics as might be thought, since these generally involve continuously increasing magnitude, and in which therefore the introduction of whole numbers is a matter of convenience and not of necessity. Again, the data of such applications are usually only approximate, so that an answer in whole numbers, should such a thing occur, is not exact, and possesses no particular interest. Hence this theory is little studied by a very large class of mathematicians. The subject is, in fact, an isolated part of mathematics, which may be taken up or not at the choice of the student.

The earliest consideration of the theory of numbers may have been made in India; but the earliest treatise is probably that of Diophantus (third century), which consists of nothing else but problems of this science, inasmuch that the theory itself has been sometimes called the *Diophantine Analysis*. Among the chief problems of the *Diophantine Analysis* are such as these:—(1) Find the numbers the sum of whose squares shall itself be a square number, one answer of which is 5-12, since $25+144=169=13^2$. (2) Find three square numbers in arithmetical progression, one answer of which is 4:100:196—which differ by 96. The reader who would study this interesting subject is referred to the works of Euler, Jacobi, Legendre, Lagrange, Gauss, Poincaré, and Eisenstein; and more particularly to the "*Disquisitiones Arithmeticae*" of Gauss (Leipzig, 1801); the "*Théorie des Nombres*" of Legendre (Paris, 1830), and Barlow's "*Theory of Numbers*" (London, 1811).

NUMERALS. There are three simple and obvious modes of constructing symbols of number:—(1) by arbitrary invention; (2) by the choice of letters of the alphabet; (3) by a system of repetitions of a single unit, as I, II, III, IIII, &c., with marks of abbreviation.

Distinct numeral characters existed, or now exist, among the Chinese, Indians, Arabs, Phœnicians, Palmyrenes, Hebrews, Egyptians, Greeks, and Romans; and others were in ancient use among the Mexicans. Of these none can be stated with certainty to belong to the first class; the Hindu, Hebrew, and the common Greek system belong to the second; and the Roman, Phœnician, Palmyrene, ancient Greek, Egyptian, and Chinese to the third class.

The system received from the Hindus, through the Arabs, and now adopted throughout Europe, has been gradually much altered in the forms of the symbols. These ciphers were introduced by the Arabs into Spain, whence, during the twelfth and thirteenth centuries, they spread over Europe. At first they were used indiscriminately, as XX7 for 27, X5 for 15, &c.; and for some time 401 was received as meaning "forty-four." It took fully a century for the pure Arabic system to become familiar. The Arabic figures are plainly identical with the Gobar or "dust" ciphers of the Arabs, which are found in a tenth-century MS. written at Shiraz, in Persia. According to the Arab tradition, they came originally from India, and a comparison of the Indian numerals in their tenth-century forms with the Gobar ciphers shows this tradition to be correct.

The foregoing results were established by Woeckle ("*Mémoire sur la Propagation des Chiffres Indiens*," 1863), and they have been confirmed by the subsequent researches of Cantor and Friedlein. But the source from which the Indian ciphers were obtained still remained an unsolved problem. Analogy suggested an alphabetic origin—either the first ten letters of some alphabet being used as numerical signs, as in the later Greek or Hebrew, or the initial letters of the words denoting the numbers being similarly employed. This last hypothesis was that adopted by Woeckle, who attempted to explain the Gobar ciphers as the initial letters of the Sanskrit numeral words from one to ten—*eka, dva, tri, catvar, panchan, shash, sapta, ashtan, nawan, dashan*—in the old Indo-Pali alphabet.

The epigraphic materials at Woeckle's disposal were obviously inadequate, and later researches have shown that his theory is untenable by tracing the ciphers back to the numerical signs employed in the inscriptions of the western caves of India, which are assigned to the first century of our era. When these primitive forms of the Arabic numerals are compared with the letters of the Indo-Pali alphabet, as exhibited in the inscriptions of Asoka (250 B.C.), they are seen to have no true connection with them. But on a rock at Kapur-di-giri, west of the Indus, on the very frontier of Afghanistan, there is engraved a copy of these same Edicts of Asoka written in a totally different character, which may be styled the *Indo-Bactrian*

alphabet. This is an alphabet of the Pehlevi type, and ultimately of Aramean origin. It is best known from the Kapur-di-giri inscription, but it is also employed on coins and inscriptions of the Bactrian and Indo-Scythian princes from the time of Asoka (250 B.C.) down to the year 79 A.D., when it finally becomes extinct. It is from this alphabet—the early alphabet of Bokhara, Afghanistan, and the Punjab—that the Arabic numerals have been derived, taking the initials of the Sanskrit numbers as written in the characters of Indo-Bactria. As with the Chinese, Egyptians, Romans, and the oldest Greeks, the first three symbols are simple strokes. See Plate III.

The identity in form of the Cave cipher for 5 and the Indo-Bactrian *p* (*panchan*), is so absolute as to leave nothing to be desired. The case of the 4 is, perhaps, even more convincing, as the forms are more complicated, and therefore a merely accidental similarity is less likely. In Sanskrit, "four" is *kutvar* or *chutvar*, and the Cave cipher for 4 closely resembles the Indo-Bactrian character for *ch* (or soft *k*), and is almost indistinguishable from the slightly differentiated character which stands for the almost indistinguishable guttural sound *chh*. "Six" and "seven" are *shash* and *saptan* in Sanskrit, and here again the Cave ciphers for 6 and 7 correspond very tolerably in form with the two Indo-Bactrian sibilants *s* and *sh* (*sh*), but the sibilants are interchanged. The origin of the ciphers for 8, 9, and 10 is not so obvious, but the cipher for 8 is referable to the conjectural ligature *as*, for *ashtan*, eight, and that for 9 to *n*, the initial of *navan*, nine. Another origin for the European figure 8 is suggested, which seems perhaps more likely to be true. According to this the cipher would be composed of two fours reversed in direction, and superposed the one on the other, just as the Roman figure ten, *X*, is made up of two fives. If this be done with the tenth-century Indian 4, two closed loops will be the result, and twice four will be practically shown to be 8.

The above account is clearly shown in the table on Plate III., which exhibits the chief stages in the history of the Arabic numerals. The first column shows the ciphers of the fourteenth century, when they had practically assumed their present forms. The second column gives the earliest European forms, from MSS. of the twelfth century. The Gobar numerals of the Arabs come next. The three following columns contain the Indian ciphers of the tenth, fifth, and first centuries, and are followed by the alphabetic prototypes taken from Indo-Bactrian coins and inscriptions of the second and first centuries B.C. The current 5 in one stroke is still in universal use in France and many other countries.

The Hebrews used the letters of their own alphabet, giving the finals a separate and particular value, as follows:—

א	ב	ג	ד	ה	ו	ז	ח	ט	י
1	2	3	4	5	6	7	8	9	10
כ	ל	מ	נ	ס	ע	פ	צ	ק	
20	30	40	50	60	70	80	90	100	
ר	ש	ת	י	כ	ל	מ	נ	ס	ע
200	300	400	500	600	700	800	900		

The use of the final letters, as signifying numbers, is of newer date than the rest; the old system required the junction of subordinate numbers to express 500, 600, &c.

The Greeks had three distinct methods of expressing numbers; but the first of them, which consists in the use of the letters of the alphabet to denote the successive books of a work, as in the *Iliad*, is as much a method of naming as of counting. Something more to the point is the old system which occurs on inscriptions, in which the unit is represented by a single mark, five by *II* (the initial

of *IIENTE*), ten by *Δ* (that of *ΔΕΚΑ*), and 100 by *Η* (that of *ΗΕΚΑΤΟΝ*). See Plate I.

The later Greek notation is as follows:—

α	β	γ	δ	ε	ς	ζ	η	θ	
1	2	3	4	5	6	7	8	9	
ι	κ	λ	μ	ν	ξ	ο	π	ρ	
10	20	30	40	50	60	70	80	90	
ς	τ	υ	φ	χ	ψ	ω	α	β	
100	200	300	400	500	600	700	800	900	
α	β	γ	δ	ε	ς	ζ	η	θ	
1000	2000	3000	4000	5000	6000	7000	8000	9000	

The *Roman* notation resembles the older Greek in its principle. It is shown on Plate I. An improvement, though it was an additional complication, was introduced upon the Greek system, and consisted in the notion that a symbol placed *before* another symbol might represent the lessening of the value of that symbol by the amount named. Thus *V* being five, *IV* is one-less-than-five, and is perhaps more legible as a symbol than *IIII*, four strokes. Certainly *IX* and *XIX*, which on the same principle represent 9 and 19, and *XL* and *XC*, which represent 40 and 90, are more readily capable of apprehension than *VIII*, *XVIII*, *XXXX*, *LXXXX*. But the whole system is rude, and in numbers of any length, or in calculations, proved so unworkable that the refined Greeks soon abandoned it for their much superior later system of alphabetical symbols, given in the text above; and a full account of the manner in which this was used will be found in the article *ARITHMETIC*. The ancient Greek system *II*, *Δ*, and *Η* are seen to be simple initials of *pente* (5), *deka* (10), and *hekatont* (100); but the Latin *V*, *X*, and *L* are not so derivable. These come from other sources; *V* is the shape of the hand seen edgewise with separated thumb, and it is evident that we should most readily count by our fingers, "one, two, three, four, the hand;" in fact the Persian word for hand is *pentscha*, which is manifestly the Sanskrit *panchan*, Greek *pente*, and our own *five*. [See *NUMBER*.] The symbol *X* is simply twice *V*, the two *V*'s being joined by their points. The symbol *L* is half *C*, the archaic form of *C*; and *C* is probably merely the initial of *centum* (a hundred). The Roman *Mile* (a thousand) gave the initial symbol *M*, and as half of this sign was closely approximated by the letter *D*, or the combination *Cl* and *Id*, these were held to serve for half-a-thousand, i. e. 500.

The *Phœnician* and *Palmyrene* numerals, two interesting series, are also shown upon Plate I.

The extremely similar system of the ancient *Egyptians* (shown in Plate II.) demonstrates once more how much of Greek civilization (and therefore of Latin also) came from that wonderful people. It shows also, compared with what has been given above in this article, the futility of the attempts of our forefathers to derive our symbols from Egyptian sources. A grave exception to this remark seems to be as to the figures 1, 2, 3 in the "numerals for days," but a moment's thought will show that these symbols must necessarily be alike in almost all notations, for they are made up of a vertical stroke, and of two and three horizontal strokes respectively, with the slightest possible connection, such as would naturally arise to save the reed from being lifted from the papyrus.

The *Chinese* symbols (Plate III.) further prove the justice of this remark in both the first and the third series, as regards 1, 2, 3. The chief symbols of all three notations are given in a complete series. See also the curious binary Chinese scale of Fohi in the article *NUMERATION*. It is easy to trace a considerable resemblance to the Roman system in that of the Chinese. Like the Romans the

figures for 1, 2, 3, 4 become those for 6, 7, 8, 9, with a prefix, 5 and 10 being separate figures. Twenty is expressed by the figure 10 with a multiple 2, not as with the Romans by two figures of 10; and so with higher multiples. The Roman system is simpler for the smaller figures, but for large sums the Chinese is far more expeditious.

The ancient *Mexican* numerals (shown also in Plate III.) are very simple. The numerals up to 20 are composed of groups of dots arranged in conventional forms; 20 has a sign—a flag—probably because a flag was the sign of an officer commanding 20 men. As in the French system, with its archaic four-twenties (*quatre-vingt*) to represent 80, the Mexicans reckoned by so many times 20, i.e. so many flags. The square of 20, i.e. 400, had the next higher separate sign—a plume—and the cube of 20, i.e. 8000, had the next, a purse, evidently all symbols of high office. Half or a quarter of these numbers might also be represented by half or a quarter of their signs.

NUMERALS, in grammar, form a curious class of words by themselves, having a threefold character, as substantives, adjectives, and adverbs. When we say "two and two make four" the numerals are clearly substantives, as also in the expressions "number one," "number two," "the hundred," "the thousand," &c. We have two words which express number, but are not numerals properly so called—first, the *dozen*, a group of twelve; and secondly, the *score*, a group of twenty. The latter is simply derived from the habit of our ancestors to notch or score accounts upon a tally or narrow piece of split wood, a mode of keeping accounts used in the customs and excise until almost the present century; when the tally was full of notches, which occurred at about twenty, the score was full. The other word, *dozen*, is the French *douzaine*; and it seems a pity that we did not borrow more words of the kind while we were about it. Their words, *huitaine*, *dizaine*, *quinzaine*, *vingtaine*, *trentaine*, *quarantaine*, &c., expressing the abstract idea of a group of eight, ten, fifteen, twenty, thirty, forty, &c., as in our dozen, and giving moreover the notion of a round number or approximation to the truth, which is so very valuable, have no counterparts in our language. In clerical circles the octave is used where the French would use *huitaine*, as a week of prayer following on certain festivals, &c., and in music the octave has a somewhat similar use for a group of eight notes considered collectively.

The distinctively numerical sense of numerals is certainly adjectival in its nature, as three books, four men, &c., where the numerals express a quality or relation of the noun; but even here there is a great distinction, for if we say "good books" we mean not only that all the books are good, but also that every single book is good by itself, whereas in "three books" the adjective three only belongs to the group as a whole, and by no means to each individual member of the group.

Hitherto we have been considering the cardinal numerals, as one, two, three, four, &c. Their derivatives, the ordinal numbers, are of course purely adjectival in character, as first, second, third, fourth, &c.

Finally, there are the adverbial numerals, forming another derived series, as once, twice, thrice; or formed by a suffix, as twofold, threefold, &c., or as dou-ble, tri-ple, &c.; or by the addition of the word *times*, as three times, four times, &c., which is the most usual method. Multiplicatives are expressed by putting two cardinal numbers together, as three score, four hundred, where the full expression is evidently "three times a score," "four times a hundred." Distributives are expressed by the forms "one at a time," "by ones," "one by one," &c., or in another series by "one apiece," "one each," &c.

The derivation of the words forming our numerals is one of the most involved chapters of philology. The ancient Sanskrit series up to ten was *eka*, *dva*, *tri*, *catvar*, *panchan*, *shash*, *saptan*, *ashtan*, *navan*, *dashan*, where we see

the oldest surviving list of numbers of those Aryan progenitors from whom we, by another stem, also derive our language. Many of these numerals at once show their common origin with our own; but a comparison of a few other languages of the Aryan stock will make this point clearer.

English.	Old English.	Gothic.	Latin.	Greek.	Sanskrit.
one	an*	ains	unus	eis	eka
two	twa	tvai	duo	duo	dva
three	thri	threis	tres	treis	tri
four*	feower	fidvor	quatuor	tettares	katvar
five*	fif	fimf	quinque	pente	panchan
six	six	sahs	sex	hex	shush
seven	seofon	sibun	septem	hepta	saptan
eight	eahta	ahtau	octo	okto	ashtan
nine	nigon	nium	novem	ennea	navan
ten	ten*	taihun	decem	deka	dashan
eleven	endiif*	ainlif	undecim	endeka	ekadasha
twelve	twelf	twalif	duodecim	dodeka	dvadasha
hundred*	hund	{taihun- tehund}	centum	hekaton	shata
thousand*	thusend	thusendja	millio	chilioi	sahasras

Those words marked with an asterisk need some explanation. *An* shows that our indefinite article, *a*, *an*, is simply one. Four and five are for *forth* and *fyf* evidently. Ten, or *ty* in Old English, stands evidently for *tegen*, whence the *-ty* in our *teen-ty*, *thir-ty*, &c. Eleven comes from the Old English *endiif*—that is, *en* (one) *lif* (ten), *lif* being an alternative form of *tig*, ten; *un-decim* exactly corresponds to *antiq*—i.e. to *en-lif*. Twelve is, of course, in the same way from *twa-lif*. The numbers from thirteen to nineteen are simply the addition of *ty* or ten to the cardinal numbers. Hundred comes from *hund*, the shortened form of *taihund*, and *-red* is still used in Iceland as equivalent to our *-tig* or ten; so that hundred is equal to *ten-ty*. *Hund* is seen to be a modification of the root which gives the Latin its *cent-um*, the Greek its *he-katon*, the Sanskrit its *shata*. (The Gothic form is seen to mean *ten-ten*.) Thousand is manifestly a compound of ten and hundred welded together. The Latin *millio*, the Greek *chilioi*, and the Sanskrit *sahasras* have no relation to our thousand. The Sanskrit word means "a going-together"—i.e. a multitude. The Sanskrit has separate names not only for the hundred and the thousand (10^2 , 10^3), but for all powers of ten up to the seventeenth (10^{17}), 100,000,000,000,000,000—a hundred thousand millions of millions.

The ordinals, with the exception of "first" and "second," are etymologically formed from the cardinals; originally superlative forms made by the suffix *-ta* (*-th*). "First" is the regular superlative of the Old English *fore*; and the superlative of *fore* being *forma*, whence our word foremost, still the equivalent of first. Chaucer has "Adam our *forme* fader" for first father. "Second" is simply the French *second*, from the Latin *secundus*; and it replaced the genuine English word *other*. The Old-English series was *first*, *other*, *thridde*, *feortha*, *fifta*, *sixta*, *seofotha*, *eahto-tha*, &c.

NUMERA'TION is a term generally applied to the art of representing numbers by distinct names and symbols. [For the actual symbols, see **NUMERALS**.] The fingers of the hand, or of both hands, or the united number of fingers and toes, furnished natural collections of reference on which the various quinary (5), decimal (10), and vicenary (20) scales in existence have proceeded. The transition from counting by tens to counting by dozens might have been caused by the facility of subdivision which the number twelve possesses, at least if we assume that the division of the Roman *as* into twelve *uncie* may be explained on the same principle.

Quinary and decimal scales of numeration are by no means the only possible scales, perhaps not even the best

ones. There is very much to be said in favour of a duodenary scale, though of course it is now too late to introduce it. The "decimal notation" and "system of local value" are distinct things. When we agree that 10 shall stand for ten, we merely express that a number in the second column from the right shall stand for ten times as much as the same in the first column. But we are at liberty to suppose that a number in the second column shall mean nine, eight, or any other number of times what it does in the first. Thus, if we choose a *quinary* scale, in which 10 stands for 5, we reject the symbols, 6, 7, 8, and 9, and our numerical scale runs thus—

1	2	3	4	10	11	12	13	14	20	21	22	&c.
one	two	three	four	five	six	seven	eight	nine	ten	eleven	twelve	&c.

Thus 20 is *ten*, because 2 in the second column counts 5 times 2. But if we choose a higher scale than the decimal, we shall have to invent, instead of rejecting symbols; if, for instance, we take a *duodenary* scale, in which 10 means twelve, we are left without symbols for *ten* and *eleven*. Let *t* and *e* stand for these; then our scale of number, beginning from ten, is as follows:—

t	e	10	11	12	13	14	15	16	17	18	19	1t	1e	20	&c.
ten	eleven	twelve	thirteen	fourteen	fifteen	sixteen	seventeen	eighteen	nineteen	twenty	twenty-one	twenty-two	twenty-three	twenty-four	&c.

But the scale which best exemplifies the principle is the *binary*, in which 10 stands for 2, and in which there are consequently no symbols except 1 and 0. A Jesuit at Peking communicated to Leibnitz the following Chinese symbol, called by them the *Cova* or *lucation*, and attributed to Fohi, the founder of the empire. It is suspended in their temples, and considered as a mystery—

— — — — —
 — — — — —
 — — — — —
 — — — — —

If the long line be interpreted to mean *one*, and the broken line *nothing*, these symbols, each being read from the bottom to the top, give a system of binary arithmetic from 0 to 7 (both inclusive) thus, 0, 1, 10, 11, 100, 101, 110, 111. And a larger *Cova*, which goes up to 63, is also spoken of as existent. It seems curious to us, with our separate names up to twelve and our separate symbols up to 9, that nations should ever have existed who had no number-words beyond two; but many examples are known even at the present day. Thus in New Guinea all the hill tribes in the neighbourhood of Port Moresby, the Tabure, Korairi, &c., use the following scale, "one, two, one-two, two-two, two-two-one," &c., for 1, 2, 3, 4, 5, &c. (*abute, igou, abute-igou, igou-igou, igou-igou-abute*); and they also express five by the outstretched hand, ten by joining the hands, twenty by joining hands and feet. The tribes round the Torres Straits islands have the same scale, but with the words *urabon, ukasar*, and differing in saying "two-one" to express three, instead of "one-two," &c. Tribes counting only up to two, three, four, &c., are also referred to in ARITHMETIC.

Our present numerative system employs the words unit, ten, hundred, thousand, million (*millione*, great thousand, the Italian augmentative form in *-one*, introduced in Italy in the fourteenth century, precisely as we say *gross* for a dozen dozen, i.e. a "big dozen"). Billion, trillion, quadrillion, quintillion, &c., though defined by arithmetical writers, have never found their way into common use, the want of such large numbers having never been experienced. The French have naturalized the term *milliard*, meaning

one thousand millions, in matters of public debt and revenue. The billions and higher denominations were never anything but a fancy of arithmetical writers, conceived after the time when elementary works ceased to be written in Latin. The probability of this is increased by their meaning different things in different countries; with us the billion is a million of millions, a trillion is a million of billions, and each denomination is a million of times the one preceding; with the French and the other continental nations (though not with some of the older Italians) the billion is a million of millions, and the trillion a billion of billions, and so on.

The Americans have introduced the absurd fashion, which is frowned upon by their best writers, and is to be hoped will not endure, of calling 1000 millions (the French *milliard*) a "billion," 1,000,000 millions a "trillion," &c., proceeding by thousands therefore instead of by millions as we do. This is to throw away the meaning of billion, tri-billion, quadri-billion, &c., when the bi, tri, quadri, stand for the second, third, and fourth powers of a million (1,000,000², 1,000,000³, &c.)

Several quaint uses of these terms of number have come down to us from our forefathers, who in taking a quantity of goods always desired something more than theiggardly true-tale. Thus a *pair* of arrows means (or meant in the days of archery) not two, but *three*; since, say the books very wisely, "one of the arrows sometimes breaks." A *dozen* in our wholesale trades means *thirteen*, popularly known as the "baker's dozen;" and there is a growing custom among "undercutters" to make the half dozen mean 7. The *hundred* (pounds weight) weighs 112 lbs.; and in timber, fish, and some other articles which are counted, the hundred means 120; and with the Belgians it even goes to 161. The use of the "long hundred" of six score is positively preserved in the old rhyme—

"Five score of money, men, and pins,
 Six score of all other things."

The furlong, instead of being 200 yards, is 220; the fikin, instead of being 8 gallons, is 9; the sack of wheat has 5 bushels, not 4; the load of corn, &c., has 5 quarters, though all the rest of creation is content with 4. (We sometimes hear truly of the "five quarters of the world," when Australia claims equality as a continent.) On the other hand, stuff a yard wide in wholesale drapery language by no means comes up to 36 inches in a great many materials.

NUMERATOR (or Numberer), the part of a fraction which states how many of the aliquot parts of a unit are taken, such as are described by the denominator. Thus $\frac{3}{4}$ being three-sevenths of a unit, 3 is the numerator. The ancient Greek expression of fractions was, however, the reverse of this; the practice being to put the numerator below and to the left, and the denominator above and to the right. Thus $\frac{3}{4}$ would be what we should now write as $\frac{3}{4}$.

NUMERIAN, one of the sons of the Emperor Carus, and his successor for a few months in the empire: murdered during an illness by Aper, prefect of the guard, A.D. 283. [See CARUS.] DIOCLETIAN avenged and succeeded him.

NUMIDIA was originally bounded on the E. by the territory of Carthage; on the W. by the river Mulucha, the modern *Molaya*; on the N. by the Mediterranean, and on the S. by the Gætuli. (Much of it is represented by the modern state of Algeria.) The terms Numidia and Numidians are derived from the Greek *Nomades*, a pastoral people.

It was during the second Punic War that the Romans became acquainted with the two great tribes of Massæsyli, whose king then was Syphax, and Massylii, whose king was Gala. Massinissa, the son of Gala, became the ally of

the Romans; and at the close of the second Punic War he obtained all the dominions of Syphax, thus uniting the two divisions of Numidia under one sceptre, and also a large part of the Carthaginian territory. He died B.C. 148, and was succeeded by his son Micipsa, who lived till B.C. 118, and bequeathed his kingdom to his two sons, Adherbal and Hiempsal, and to his nephew Jugurtha. Jugurtha murdered the two other kings and usurped their possessions. The result was a war with Jugurtha, his defeat by the Romans, and his death, B.C. 106. [See JUGURTHA.] Hiempsal II. was king of Numidia after Jugurtha, and he was succeeded about B.C. 50 by his son Juba I., who took a part in the civil wars against C. Julius Cæsar. On the death of Juba, B.C. 46, Eastern Numidia was made a Roman province by Cæsar, who gave the administration to Sallust the historian. Western Numidia was included in the Roman province of Mauritania.

The chief town in Numidia was Cirta, now *Constantine*; Hippo Regius, near the site of the present *Bona*, was not far from the coast; it was the see of St. Augustine.

NUMISMATICS (Gr. *nomisma*, Lat. *nummus*, a coin), the science which treats of the age and character of coins and medals. A coin is a piece of metal struck for the purpose of circulating as money; a medal is designed to commemorate some past event or illustrious personage. The face of a coin or medal is called the *obverse*, opposite to it is the *reverse*. The words around the border form what is termed the *legend*, in the middle the *inscription*; and in the lower part of the piece, and separated from the rest by a horizontal line, they are called the *exergue*.

Under the heads of **COIN** (see *Plates* also) and **MEDAL**, the subject is treated at some detail.

NUM'PHAL. See **NUMPHUS**.

NUN'CIO. See **LEGATE**.

NUNEATON, a town of England, in the county of and 19 miles N.N.E. of Warwick, and 97 miles from London by the London and North-western Railway, situated on the Coventry Canal. It is a brisk, stirring place, with a considerable trade in cotton, woollen, and worsted spinning, while in the neighbourhood are various collieries and foundries. The first part of its name was derived from the Abbey of St. Mary, the foundations of which and the bases of the tower piers are still to be seen. The parish church contains some interesting monuments, and the Church of St. Mary, erected in 1877, is built in imitation of the style of the old abbey. The town has a grammar-school, a library, and a literary institute. The population in 1881 was 8465. Nuneaton was the birthplace of the novelist George Elliot (Mrs. Cross).

NUNS, NUNNERIES. See **MONASTICISM**.

NUREMBERG or **NUERNBERG**, a large town of Germany, in the Bavarian province of Middle Franconia, formerly a flourishing member of the Hansatic League, is situated on a high and well-cultivated plain on the Pegnitz, which divides the city into two unequal parts, and forms three islands within the walls, which are connected with each other and the city by several bridges. The town is surrounded by an old wall pierced by eight gates, flanked by a great number of towers, and girt by a moat nearly 200 feet broad. The circuit within the walls is $3\frac{1}{2}$ miles, within which space there are many squares and gardens, and a short distance outside the walls is a handsome public park. The streets are in general broad and well paved, but crooked and irregular, and the town retains more of its mediæval aspect than almost any other of the same size in Germany. One of the most remarkable buildings is the old fortress, which stands on a steep eminence. The town-hall, one of the finest in Germany, contains, among other curiosities, a number of paintings by Albert Dürer. Almost all the churches are worthy of observation for their architecture and the works of art which they contain. Near the Church of St. Egidius is

the gymnasium, in front of which there is a statue of Melanchthon. The city also contains a handsome monument to Hans Sachs, erected in 1874. The former Dominican church contains the city library of 50,000 volumes. The Frauenkirche, restored in 1881, is still in possession of the celebrated mechanical clock made in 1509, and called the Maennleinlaufen, the name being derived from the figures of the seven electors who, as each hour struck, came out and revolved round the central figure of the emperor.

Nuremberg has given birth to many distinguished men, including, among others, the famous painter Albert Dürer in 1471. Several important inventions in the arts are said to have been made in this city. The celebrated machine for drawing wire is supposed to have been constructed by Rudolph, a native of this city. Gun locks are believed to have been first fabricated here in 1517. Owing partly to these inventions, but more to the freedom and industry of its inhabitants, Nuremberg early rose to great eminence as a manufacturing and commercial town. Cannon are said to have been cast here as early as 1356, and in the same century it furnished paper and playing cards. It had also a very extensive trade. It produces various species of metallic goods and jewelry, with telescopes, mirrors, mathematical and musical instruments, lacquered wares, and lead pencils. There are considerable factories for the manufacture of ultramarine and railway carriages. Though considerably declined, Nuremberg still ranks as one of the principal commercial cities of Bavaria.

Nuremberg has many well-conducted public institutions—viz., a gymnasium, a polytechnic institution, several free schools, a training school, a society for the promotion of manufactures, &c. The town was founded in 905, and in 958 became the seat of the first German Diet. The first railway for locomotives in Germany was completed in 1835–36 between Nuremberg and Fürth, a distance of $4\frac{1}{2}$ miles. The Emperor of Germany bears the title of Burgrave of Nuremberg.

NURR (or **KNURR**) AND **SPELL**, the ancient Yorkshire game whence “trap, bat, and ball” has been derived. The “spell” was an elastic tongue of metal held down by a spring, and in the cup at its end reposed a wooden ball or “nurr;” the spring being released the ball was shot upwards and was struck by a bat. The scoring is reckoned by distances of 20 feet, previously laid down.

NUT, botanically, is a one-celled fruit, with a hardened pericarp, containing when mature only one seed: popularly, a nut is a fruit which has the seed inclosed in a bony, woody, or leathery covering, not opening when ripe. Nuts and nut-produce are imported into the United Kingdom to the value of nearly £1,500,000 annually, more than one-third being purchased for the sake of the oil contained in the nuts.

So far as English taste is concerned, the chief edible nuts are the hazel, filbert, walnut, chestnut, almond, and cocconut. Our hazel nuts are nearly all brought from Spain, while filberts are grown chiefly in Kent, the soil of which is in some parts very favourable. We grow some of our chestnuts, but import most from France and Spain, in which countries, and in North Italy, chestnuts form a regular article of food. Walnuts are brought principally from France and Belgium. Almonds, our consumption of which is largely increasing, grow luxuriantly in Spain and Barbary; indeed, Spain is, *par excellence*, the country for nuts. The sweet almond, besides being eaten as a pleasant fruit, is used in confectionery and for conversion into burnt-almonds; while the bitter variety is used in making liquors, macaroons, and medicines. Pistachio nuts are principally used in cooking and confectionery, and in making soap, hair-oil, and cosmetics. Brazil nuts are brought chiefly from the country which gives them their name. Ground nuts are found in a peculiar position, just underneath the ground, whence their name. They grow abundantly in hot

climates, and are exported from the west coast of Africa in thousands of tons every year. The kernel is eaten as a fruit—parched as food, or roasted as a substitute for chocolate.

It is the oil-yielding property of nuts, however, which constitutes their chief value. Almost every kind of nut contains oil, in larger or smaller proportions, obtainable by pressure and by other means. The Brazil nut yields half its weight of a bland oil, useful in cooking and confectionery. The almond nut is rich in oil, nearly colourless, and applied to many purposes in medicine. Oil from the walnut is much used on the Continent in cooking, as a fuel for lamps, and to mix with artists' colours. Hazel nuts give up more than half their weight of bland oil, used by perfumers. The cashew nut yields oil. From the beech nut, utilized in England chiefly as food for swine, the French make coarse bread, use it as a substitute for chocolate, and obtain an oil useful in cooking. The candle nut of the East contains an oil useful in making soap, lighting lamps, and as a drying oil for painters. The nutmeg, which we import from Banda and the Straits Settlements, is chiefly known to us as a spice; but on being pressed it gives forth a concrete oil known as nutmeg-butter; while the oil called oil of mace is really oil of nutmeg, obtained by distillation. The hickory nut of the Americans is rich in a limpid oil, very serviceable in lubricating machinery and watch-work.

The cocoa-nut eclipses in importance all other kinds, and its uses are singularly numerous, valuable, and varied. Our importation of about three and a half millions annually may seem large, but it gives little idea of the luxuriant growth of this fruit in intertropical climates. There are about 280 miles of cocoa-nut trees along the coast of Brazil; Malabar alone exports 400,000,000 cocoa-nuts annually; and there are 7,000,000 cocoa-nut trees in Travancore. Each tree will yield about sixty nuts a year for sixty or seventy years, and from twelve to sixteen nuts will give two quarts of oil. The copperah, or dried kernel, is the chief source of the oil as usually obtained. In the United Kingdom the nuts are imported almost wholly for eating as a pleasant fruit, but their chief commercial value generally is for their oil. The coir or fibre which envelops the shell is also a valuable product of the cocoa-nut.

The most really important oil-nut, so far as English manufactures are concerned, is the oil-palm of Africa. The cocoa-nut tree is itself one genus of palm, but of a different kind to this. The oil from the palm-nut is obtained from the pulpy fruit which envelops the kernel, and the quantity imported into England amounts to nearly 1,000,000 cwt. annually. From the kernels, formerly thrown away, is now extracted a clear limpid oil, distinguished from the palm oil as palm-nut oil.

Valonia, used so largely by our dyers and tanners, is a portion of the nut, the acorn-cup, of an African tree. Myrobalan, another nut, is used in tanning and in ink-making. The so-called gall-nut, or nut-gall, of which the use in dyeing and ink-making is extensive, is not really a nut; it is an excrescence formed on the trunks of the oak and other trees in Southern Europe made by the punctures of the female gad-fly. Vegetable ivory, used by the million pounds at Birmingham for buttons, knobs, trinkets, &c., is the kernel of the nut of a Peruvian palm-tree, white, and exceedingly hard. Betel-nuts are used in the East for chewing, and in Europe for tooth-powder; and coquilla nuts serve the same purposes as vegetable ivory.

NUT, in music, (1) the slightly raised slip at the upper end of the neck of the instruments of the violin and guitar family, &c., serving as the upper bridge, and marking off the commencement of the sounding part of the string. (2) The piece which carries the screw of a violin bow, whereby it may be moved backwards and forwards along the stick, and the hair of the bow, which is also fixed into it, thus tightened and relaxed.

NUTATION, a term used in astronomy to denote a certain movement in the earth's axis caused by the attraction of the moon. The phenomenon was discovered by the illustrious Bradley, whose name was already famous by his discovery of the aberration of light. [See ABERRATION.] The memorable account of the discovery of nutation appeared in the *Philosophical Transactions* (p. 1, No. 485, vol. xlv.) Owing to the attraction of the sun and the moon on the protuberance at the equatorial regions of the earth, the axis of the earth does not preserve a constant direction. It follows that the celestial pole describes a small circle on the heavens around the pole of the ecliptic, the radius being $23^{\circ} 27'$, and the period of one complete revolution 26,000 years. The influence of the sun or moon will depend upon the angle between the plane of its orbit and the plane of the earth's equator. It is indeed obvious that if the plane of the orbit of the disturbing body coincided with the plane of the earth's equator, then the influence in deranging the axis must be zero. The inclination of the path of the sun to the equator is constant, so that the efficiency of the sun in producing precession is constant. The moon, however, has an inclination of 5 degrees to the plane of the ecliptic, and as the moon's nodes rotate once in eighteen years, it follows that the inclination of the moon's path to the equator fluctuates through a range of 10 degrees, completing its period in 6798 days. The efficiency of the moon in producing precession is thus variable, and as two-thirds of the precession is due to the moon, the variability becomes very manifest. It follows that the pole of the earth, instead of truly describing a small circle in the heavens, has a more complex motion. We may picture the phenomenon by thinking of the pole describing a small circle, 18 seconds in diameter, in a period of 6798 days, while the centre of that circle performs the great revolution around the pole of the ecliptic at a distance of $23^{\circ} 27'$ and in a period of 26,000 years; the true pole thus nods, as it were, to and from the pole of the ecliptic, and hence the phenomenon is called nutation.

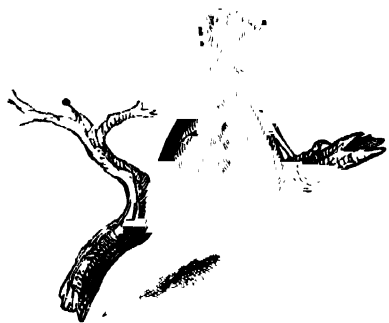
NUTCRACKER (*Nucifraga caryocatactes*) is a bird belonging to the CROW family (Corvidæ). It is a rare occasional visitor to Britain, but is not uncommon in some parts of the continent of Europe, in the pine forests of Russia and Siberia. It measures about 1.1 inches in length, and is of a clove-brown colour both above and beneath, the plumage being marked with triangular whitish spots on the extremity of each feather. The crown of the head is dark brown, without any spots; the wings are blackish-brown, as are also the tail feathers; but the whole of the latter, except the two middle ones, have a white tip, which gradually increases in extent towards the sides. The nutcracker feeds chiefly on the seeds of fir-trees and other conifers, and it appears doubtful whether, despite its name, this bird cracks nuts with its bill. It feeds also on insects and their larvae. The nest is not made in a hole in a tree, as was for long believed, but is composed of sticks lined with grass, and placed on the bough of a high tree. The eggs are five or six in number.

NUTHATCH (*Sitta*) is a genus of temirostral passerine birds, the type of the family Sittidæ. There are two common European species, the *Sitta europæa* of Linnæus, distinguished by its white breast and northerly range, and the English species, *Sitta cæsia*. This latter species is common in Central, Southern, and Western Europe, and is generally diffused in England, although not in great abundance; its occurrence in Scotland is doubtful, and it is not known in Ireland. It is a small bird, measuring little more than 5 inches and a half in length, to the extremity of the short tail. The general colour of the plumage on the upper parts is bluish-gray, and that of the lower surface light reddish-yellow; the flanks are brownish, and the cheeks and throat white, this white portion being separated

from the gray of the upper surface of the head and neck by a black band, which runs from the base of the bill to the shoulder.

Like the woodpeckers and creepers, the nuthatch runs with facility upon and about the trunks and branches of trees; but the tail, which is short and rounded, is of no assistance to the bird in its progress. The nuthatch, however, runs with the head downwards as well as upwards, and sleeps in that posture. Its food consists of insects and their larvæ, berries, and hazel nuts. The latter it fixes in some chink, and cracks them by repeated strokes of the bill.

This bird frequents woods, plantations, parks, and even gardens and orchards, resorting to the latter principally on



Nuthatch (*Sitta europæa*).

the approach of winter. It nestles in the holes of trees, making a bed of dead leaves, moss, and fragments of bark and wood, and usually taking the precaution of plastering up a portion of the external aperture of its abode with clay, so as to leave only a sufficient space to serve for its own passage. The object of this proceeding is evidently to prevent the woodpeckers, which also breed in the holes of trees, from destroying the nest or taking possession of it. The nuthatch lays six or seven eggs of a white colour, spotted with rusty red, and defends its nest with the greatest courage.

NUTMEG is the seed of the tree known to botanists as *Mysticica moschata*. It is principally cultivated in Banda, an island in the Malay Archipelago belonging to the Dutch. Though the island is volcanic and subject to severe earthquakes, almost the whole surface is devoted to the growth of nutmeg trees, which are grown under the shade of lofty canary trees. "The light volcanic soil, the shade, and the excessive moisture of these islands, where it rains more or less every month in the year, seem exactly to suit the nutmeg tree, which requires no manure and scarcely any attention. All the year round flowers and ripe fruit are to be found, and none of those diseases occur which under a forced and unnatural system of cultivation have ruined the nutmeg planters of Singapore and Penang (Wallace, "Malay Archipelago"). The fruit is gathered by means of a jointed pole like a fishing-rod, with two prongs at the tip; by these the fruit is detached and falls into a basket worked on the stem a few inches below. The nutmeg is inclosed in a thin hard shell, which is surrounded by the MACE of commerce, and the whole is inclosed in a fruit of the size and colour of a peach. Two or three gatherings of the nutmegs are made in the year, generally in July and August, in December, and in April. The third period yields the best nutmegs. The collected nuts are dried in the sun or by the heat of a moderate fire, till the shells split: they are then sorted and dipped in lime-water, to preserve them from the attack of insects. Those of good quality should be heavy, each weighing on an average 90 grains.

Nutmegs and mace, from the large quantity of volatile oil, are decidedly stimulant, and when used in abundance produce, by exciting the circulation, narcotic effects. In moderation they promote the appetite and assist digestion.

NUTRITION. The phenomena of life are accompanied by the constant and unceasing waste of the materials of which the animal body is composed. Every act of volition, every exertion of muscular power, every functional action of the organism, whether voluntary and perceptible or imperceptible and involuntary, every play of chemical affinity and decomposition, even thought itself, occasions the disorganization and destruction, as living matter, of a portion of ourselves. This loss, this change, which commences with life and terminates only with death, is compensated for by the constant renewal of the whole frame by the deposition and assimilation, or organization, of matter from the blood, which thus becomes gradually thinner and impoverished unless, in its turn, it receives a corresponding supply of its vital elements. This it does from the food, which, by the functions of DIGESTION, is converted into CHYLE, and passing into the blood, is carried to those organs and tissues whose loss it is intended to supply. This constitutes nutrition. Each part of the body abstracts from the nutritive fluid that which is required for its own growth or repair; muscle abstracting particles to form muscle, nerves from the same fluid abstracting particles to form nerve, and so on. See also ABSORPTION.

NUT-WEEVIL. See BALANINUS.

NUX (Gr. *νύξ*), in mythology, the goddess of night, daughter of Chaos and sister of Erebus (or darkness). The poets, carrying out the allegory, represent her to be the mother of Aithēr, air, and Hēmēra, the day. Her mysterious darkness was almost as terrible to the poetic minds of Greece as the Fates themselves. Zeus himself feared her, according to Homer. Many mysterious beings were created by Night, as some poets feigned, or born of her alone, such as Nemesis, the Moirai, Thanatos, Hypnos, divinities of vengeance, fate, death, sleep, &c.

NUX VOMICA. See STRYCHNOS.

NYAN'ZA or **VICTORIA NYANZA** (meaning "water"), an extensive lake of Eastern Africa, between 2° 50' S. and 0° 20' N. lat., and 31° 40' and 35° E. lon. It is 3740 feet above the sea, and its length and breadth are each about 230 miles. Its area is estimated at 27,000 square miles, and its coast-line at at least 2000 miles. The islands are numerous and extensive. The depth is said to attain 90 fathoms near the shore. The chief tributary is the Kagera or Alexandra Nile. This lake was discovered by Speke in 1859, and is the principal feeder of the White Nile, which issues from its northern side by Napoleon Channel and Ripon Falls, and thence descends into the Albert Nyanza, from which it proceeds on its course to the Mediterranean. The Albert Nyanza has an average length of 97 miles and breadth of 22 miles. The area is about 2000 square miles. Much of it is very shallow. Both the Victoria and Albert Nyanza were explored in 1876 by Stanley. See NILE.

NYAS'SA, a great lake of South Africa, which lies north-west of Mozambique, stretching in a north-west and south-east direction between 19° 20' and 14° 25' S. The lake belongs to the drainage system of the Indian Ocean, is 1500 feet above the sea, and stretches meridionally over nearly 9000 square miles in the basin of the Zambezi. Its average depth exceeds 100 fathoms. Its name means the "lake of storms," and was given to it by Dr. Livingstone in consequence of the severity of the storms which often prevail on it. The lake was thoroughly explored in 1875 by Mr. Young—in a small steamer taken from England and screwed together on the spot—with the object of establishing a Livingstonia Mission.

NYA'YA ("the investigation"), the title of one of the three great Sanskrit systems of philosophy. Each of these

is divided into two parts; thus we have the Nyaya proper and the Vaisesika: the Sankhya proper and the Yoga; and the Mimansa proper and the Vedanta. Each of these is described under the article SANSKRIT LITERATURE.

NYCTAGINEÆ is an order of plants belonging to the MONOCHLAMYDEÆ. It includes a small number of plants indigenous to warm countries, of which the only important one is *Mirabilis*, or the Marvel of Peru. This fine and brilliant flower, from its evening perfume and general showiness, is much cultivated in English gardens. In this order the perianth is petaloid, tubular, persistent, inclosing the anthers, and often adhering to it. The stamens are hypogynous. The ovary is one-celled, with a simple style. The radicle of the seed is inferior. The species are herbs, shrubs, or trees; the branches have tumid nodes and opposite leaves. The involucre of the flowers is calyx-like, and sometimes large and coloured.

NYCTIPTHECUS. See NIGHT-ARE.

NYLGHAU (*Portax picta*) is a large species of antelope inhabiting India. The nyghau is as large as a stag, standing at the shoulders, which are at a higher level than the hanches, more than 4 feet from the ground. The fur exhibits a tawny red colour generally, being in the male of a uniform bluish-gray at the upper parts. The head is furnished with a pair of short horns, about 7 inches in length, which are slightly recurved forwards; they do not exist in the female. The muzzle is remarkably attenuated; the ears are rounded, and the lachrymal sinuses rather large. The neck is broad and compressed laterally; and at the under part, near the middle line, it is furnished with



Nyghau.

a conspicuous tuft of hair. Immediately above this beard-like development there is a whitish spot; two similar patches being also seen on either cheek, below and in front of the eye. Besides these, the pasterns are marked with white spots, forming more or less distinct bands round the ankle-joints. The mane is well developed, especially over

the region of the shoulders, where it forms a thickish tuft. The tail is long and bushy at the tip.

The nyghau inhabits dense forests in India, where, notwithstanding its great strength and spirit, it often falls a prey to the tiger; when, however, chased by man, it frequently turns furiously upon the hunter, who finds a difficulty in evading its sudden onset. The nyghau has often been in captivity, both in this country and in India. The temper of the male is very uncertain in confinement.

NYMPHÆA (Gr. *Nymphæ*, a nymph) was the name of twelve public baths at Rome, which were celebrated for their beauty and convenience. They were so called because they were consecrated to the Nymphs and adorned with their statues. Near Naples and at Nîmes, &c., are still to be seen the remains of similar baths.

NYMPHÆA, the Water-lily genus, of which the British type is *Nymphæa alba*, a beautiful aquatic plant, with almost circular floating leaves and snowy rosette-shaped flowers that, encircled with foliage, peep above the surface of the water. There are many exotic species.

NYMPHÆACEÆ, an order of aquatic plants, with floating leaves and solitary flowers, found in all the hot and temperate parts of the world. The species of this order are generally plants of great beauty, either the flowers or the leaves being of unusual size. The White Water-lily (*Nymphæa alba*) and the Yellow Water-lily (*Nuphar luteum*) of our own rivers and ponds are among the finest specimens of floral development in these latitudes. In other countries both their size and colour are augmented, brilliant tints of blue and crimson being added to the pure white of our native species, and the most delicious odour being also emitted. In Demerara grows the *Victoria regia*, whose flowers have a diameter of 15 inches, while the leaves are as much as 6½ feet across. In the East Indies the *Nymphaeaceæ* emulates the *Victoria* in the size of the leaves, but its flowers are small and inconspicuous. In both these plants the farinaceous seeds are used for food. In this order, which belongs to the POLYPETALÆ, the sepals are usually four, the petals numerous, passing into the stamens; the stamens, with petaloid filaments, are indefinite in number, inserted on the receptacles above the petals; the ovary is many-celled, many-seeded, inclosed by the receptacle.

NYMPHS (Gr. *Nymphai*, Lat. *Nymphæ*) were subordinate female deities in the Greek and Roman mythology who collectively represented nature and were the objects of native worship. Those who presided over rivers, brooks, and springs, were called *Naiads*; those over mountains and grottoes, *Oreads*; those over woods and trees, *Dryads* (accurately *Dryads*) and *Hamadryads*; those over the ocean, *Okeanids*; those over the inland seas, *Nereids*; those over glens and valleys, *Napææ*, &c. They are represented as beautiful young women. They were propitiated by offerings of milk, oil, and honey, and by sacrifices of lambs; but never of wine. Another class of nymphs were local or race divinities, but these are not of frequent occurrence in the ancient myths.

NYX (Night). See NUX.

O

O, in the vowel series, if arranged according to the nature of the sound, occupies the position between *a* and *u*. *O* is the vowel which has most nearly retained its original sound; it is the most stable vowel in our speech. This is shown by its being the only vowel which is practically pronounced in the same manner in English and the other kindred languages. It has four sounds in English—two for the single and two for the double vowel; thus *not* (short), *note* (long);

wood (short), *fool* (long). Its representation is most redundant; thus the long sound (as in *note*) may be represented by eleven varieties of spelling, as *note*, *boat*, *toe*, *yeoman*, *oat*, *soul*, *soar*, *sew*, *hautboy*, *beau*, &c. Abnormal sounds of *o* are the *u*-sound in *son*; and the *au*-sound before a single *r*, as *nor*, *for*, &c. Before two *r*'s the short sound is heard as usual, as *horror*.

1. *O* is convertible with the adjoining vowel *u*; hence

arises the confusion between the Latin second or *o* declension, and the fourth or *u* declension, to both of which belong *ficus*, *cibus*, *scnatus*, *tenuellus*, *ornatus*, *laurus*, *domus*, &c.

2. With *a*. Grimm has pointed out this change as existing between the Latin and Teutonic tongues, as *dona-re*, *longus*, *odium*, &c., compared with *zähm-en*, *lang*, *kass*, &c. Hence, too, the double form of the name *Longobardi* and *Langobardi*. So, in Latin, from the root *gno* (*gnosco*) were formed *gnarus* and *ignarus*; and again, from these *narrare* and *ignorare*, in the latter of which the original vowel reappears. Thus also we get the changes in the strong verbs with *a*; as *take*, *took*, *break*, *broke*, &c.

3. With the long *e*, the sound of which must be considered as the same with the English *a* in *lane*. Hence in Greek, *Εὐπάτωρ*, *ἄπατωρ*, &c., from *πατήρ*; and the Latin *sol*, *eor* correspond with the Greek *ἥλιος* and *πῆρ*.

4. With *ou*. This interchange is virtually the same as the first mentioned. It is not uncommon in French as compared with Latin, as *nouvelle*, *novella*.

5. With *uo*, especially in Italian, as *uomo*, *buono*, from the Latin *homo*, *bonus*.

6. With *eu*, in French, as *lien*, *jeu*, *jeu*, *pen*, *leur*; from the Latin *locus*, *ficus*, *jocus*, *pauci* (and Italian *poco*), *illorum*.

7. With *au*. This exists within the Latin; as *canda* and *coda*, *caude* and *coda*. *Claudius* and *Clodius*, *plaudo* and *plodo*. So from the Latin *aurum*, *audere* (whence the frequentative *ausare*), *Aufidus*, the Italians have *oro*, *osare*, *Ofante*; and the French *or*, *oser*. Hence, too, the French pronunciation of the diphthong *au*.

8. With *ou*. Thus, the English words *boat*, *oath*, *oak*, must have received their present orthography when both the vowels were pronounced, as they still are in some parts of England, *bo-at*, *o-ath*, or *boo at*, *oo-ath*.

9. With *ue*, as in Spanish *bucna*, *bugo*, *fuego*, *huesped*; from the Latin *bonus*, *locus*, *ficus*, *hospes*.

10. An initial *o* with *hue* or *hui*. Hence from the Latin *ostium*, *ostiarius*, are derived the French *huis*, *huissier*, and the English *usher*. From the Latin *os*, a bone, *orum*, an egg, the Spaniards have *hueso*, *huero*. From the Latin *octo*, *ostrica*, come the French *huict* or *huit*, *huître* or *huitre*.

11. In the paragraphs numbered 5, 9, and 10 the *o* really takes the sound of the English *u*, or the Greek digamma; and the same is the case in the Greek language itself, as in *είκος*, *είκος*, *είδα*, tor *Feikos*, *Feivos*, *Feida*, which may be compared with the Latin *ricus*, *rinum*, *video*.

12. With *ea*, as between German and English. Thus the former language has *strom*, *brod*, *gross*, *tod*; the latter *stream*, *bread*, *great*, *death*. The same change exists in the English by itself, as *cleave*, *clove*; *weave*, *wore*.

13. With *ei*, pronounced as the English long *i*. This is exceedingly common in the same languages. Compare the German *beide*, *bein*, *ein*, *kleiden*, *mannheit*, *zeichnen*, with *both*, *bone*, *one*, *clothe*, *manhood*, *token*. This change also exists within the English language, as *shine* and *shone*, *strike* and *stroke*, *drive* and *drove*.

(*O*) is a common prefix in many Irish family names, and serves as a patronymic, like *Fitz* in Norman, *Mac* in Scotch,

and *Ap* in Welsh names; that is, O'Connor, means the son of Connor. Its origin is uncertain; it has been ascribed to the Irish *ua*, a grandson, and the Gaelic *ogha*, also a grandson, and is certainly the English *of* in the Lancashire idiom Tom o' Ben's, o' Jack's (Tom, son of Ben, son of Jack).

A sharp distinction should be, but often is not, drawn between the vocative *O*, as, "O Lord," and the exclamatory *oh*, as, "Oh the difference to me."

The symbol *O* originally represented an eye, and its Hebrew name is still *ayin* (eye).

OAK (*Quercus*) is a genus of trees belonging to the tribe *Quercineæ*, of the order *CUPULIFERÆ*. Associated with the oak in the same tribe are the beech and the sweet chestnut; from each of these genera it is distinguished by the nut being surrounded by a cup, and by each of the cells of the ovary containing two ovules.

Oaks, like roses, are scarcely known in a wild state in the southern hemisphere. In the islands of the Indian Archipelago they reach their most southern limits, extending as far as Java; thence they pass upwards beyond the equinoctial line, and following the eastern parts of Asia, they spread to the westward along the Himalaya Mountains, and reaching Europe are only arrested by the



Common British Oak.

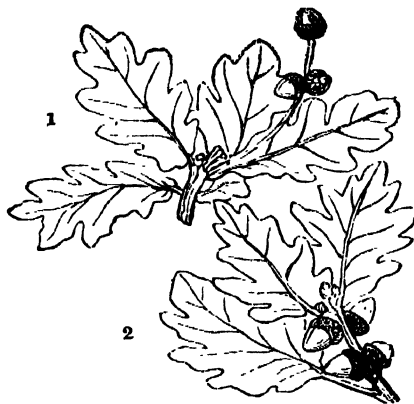
Atlantic Ocean. On the other hand they find their way to the eastward of their Asiatic origin, and overrun America from Canada through California and Mexico, till their progress to the south is stopped by the Isthmus of Panama.

The species of oak are extremely numerous—together not fewer than 300.

I. OAKS OF EUROPE, NORTHERN ASIA, AND NORTHERN AFRICA.—Under this head we include all the more common species of the genus, the greater part of which exist in cultivation in this country. They may be divided into three groups—the Forest Oaks or *Robora*; the European Oaks or *Ilices*; and the Mossy-cupped Oaks or *Cerris*.

The Forest Oaks (Robora).—The oaks of this group have thin deciduous leaves, and the acorn-cups are shallow.

Quercus pedunculata (the common British oak). This species has the reputation of being the true British oak, whose timber is alone suited for naval purposes on account of its durability and hardness; but this is a mere fable,



1. *Quercus pedunculata*. 2. *Quercus sessiliflora*.

the wood of *Quercus sessiliflora* being as suitable in all respects under similar circumstances. But the timber of the oak, like all other wood, is materially affected by the nature of the soil in which it grows, and this has probably given rise to the often-repeated assertion that Sussex oak, which chiefly consists of *Quercus pedunculata*, is the best kind that can be employed in shipbuilding. The species is readily known by its leaves having very short stalks, or none at all, while the acorns are placed on very long stalks.

Quercus sessiliflora (durmast oak). Experiments as to the strength and toughness of the timber of this species have shown that there is no material difference in those respects between it and that of *Quercus pedunculata*, and the durability of the wood of the sessile-cupped oak is attested by the fact that the roof of Westminster Hall is constructed of it, and not of chestnut, as has been sometimes said. *Quercus sessiliflora* is found all over England, but nowhere in great quantity. It is, however, most abundant in the west, and constitutes the greater part of the oak of North Wales. It is a much handsomer tree than the last, and grows considerably faster.

The *Quercus fastigiata* of the gardens is a singular variety, with the branches rising close to the stem, like those of a Lombardy poplar.

Quercus pubescens, a native of the southern parts of Europe, has most of the characters of *Quercus sessiliflora*, and is considered by De Candolle to be only a variety, but its leaves are smaller, and are often quite woolly on the under side. It forms a majestic tree, with much the habit of *Quercus Cerris*.

The Evergreen Oaks (Ilices).—All the European oaks with leaves truly evergreen belong to this section, which, however, in some respects approaches the mossy-cupped oaks when the latter acquire a semi-European habit.

Quercus Ilex (common evergreen oak or holm oak), a most variable plant, common all over the south of Europe,

where it may be found with leaves varying from being as prickly as a holly to being as even at the edge as an olive, and from the size of a sloe-leaf to that of a beech-leaf. It loves the neighbourhood of the sea, and in its wild state generally grows singly or in small clusters, not forming forests. Its wood is very hard and heavy, tough, and in all respects of excellent quality, where its weight is not against it. Its acorns are bitter and unfit for food.

Quercus Ballota (sweet acorn oak). This evergreen oak is one of the leading vegetable features of nearly all Spain. The native woods are formed of it in a great measure. It is also common in Algeria. De Candolle does not consider it distinct from *Quercus Ilex*. The great and essential difference is in the acorns, which are eatable, and when in perfection are as good as or superior to a chestnut. To give this sweetness they must be kept, as at first they have a considerable taste of tannin, which disappears in a few days. These are the edible acorns of the ancients.

Quercus Suber (cork-tree). The cork-tree is spread through all the warm parts of Spain, but is most abundant in Catalonia and Valencia, whence the principal exports have been made. In the property of forming a spongy soft substance on its bark it surpasses all other European trees, and hence it is of the greatest value for corks and for similar purposes. The form of the tree is altogether more beautiful than that of the common evergreen oak, and in the districts suited to it it attains a great height. The species bears the climate of London, but acquires little of its natural beauty in this country.

Quercus coccifera (kermes oak), a native of the south-eastern parts of Europe, where it forms a small bush resembling a dwarf holly. It is celebrated as being the haunt of the kermes insect, which yields so brilliant and permanent a blood-red dye that the old Flemish tapestries, dyed with it two centuries ago, have lost none of their brilliancy.

The Mossy-cupped Oaks (Cerris).—In this group the leaves are thin and deeply lobed, and the scales of the cup are long and narrow.

Quercus Cerris (Turkey oak), an exceedingly common plant all over the south of Europe, which is now very frequently planted in Great Britain. It has an open, straight,



Quercus Vaulonia.

graceful mode of growth, very different from the gnarled and tortuous appearance of native British oaks, than which it also grows much faster. Its leaves differ from those of the common oak in their acute lobes. The timber of this oak is beautifully mottled in consequence of the abundance of its silver grain, and in other respects is equal to that

of any other species. It is extensively imported into the United Kingdom for shipbuilding and other purposes.

Quercus Vallonea (great prickly-cupped oak or valonia). Asia Minor produces this valuable tree, which yields the acorns called velani or valonia in commerce, of which many tons are imported yearly for the use of tanners. The tree is reported to be handsome in its own country; but with us, although it has long been cultivated, it is an inelegant tree, of a stunted mode of growth.

II. OAKS OF THE LEVANT.—*Quercus infectoria* (Oriental gall-oak), a very common plant in Asia Minor, where its branches are attacked by an insect, the *Cynips scriptorum*, which punctures them and causes the formation of the oak-galls so well known in commerce. It forms a scrubby bush rather than a tree, and is of no value except for its galls. This form is now placed under *Orientalis*, a subspecies of *Quercus Lusitanica*.

III. OAKS OF THE HIMALAYAS, CHINA, &c.—*Quercus incana* (the Himalayan Ilex), a beautiful tree, very like the evergreen oak of Europe. Its leaves are much more woolly on the under side.

Quercus lanata (woolly-leaved Nepal oak) is a variety of the Himalayan Ilex. This is one of the handsomest oaks yet discovered, and it exists in a living state in the gardens of this country; but as might be expected from its native localities, it is not hardly enough to bear the climate of London without protection.

Quercus chinensis (the Chinese oak), a beautiful Chinese species, found (by the botanists attached to the Russian mission to Peking) in mountainous places. It has almost precisely the habit and appearance of a Spanish chestnut.

IV. OAKS OF NORTH AMERICA.—In general these are cultivated in England, where they are found tolerably hardy. They, however, evidently suffer from want of summer heat, and are by no means of the same value to us as the species of the continent of Europe.

Quercus alba (white oak), a very fine species, producing sweet acorns and excellent timber, and approaching nearer to the European forms than any other American species. Specimens of it in the American forests are often 70 or 80 feet high.

Quercus Prinus (chestnut-leaved white oak) is a tree of much beauty, varying considerably according to soil and situation. The wood is porous and not of very good quality, but the broad bright green foliage is handsome.

Quercus coccinea (scarlet oak). The middle states of North America abound in this and the following species, which derive their name from their leaves becoming in the autumn of a rich crimson colour. It forms a large and graceful tree, but the wood wants massiveness. The wood is of very little value and perishable; it is only employed for fuel and for staves for casks intended to hold dry goods. It grows fast, and stands the climate of even the colder counties of England.

Quercus rubra (mountain red oak) is a large tree with sinuated and lobed leaves. It yields a great part of the red oak staves exported from Canada and the north of the United States to the West Indies; but red oak staves are also produced from the preceding species (scarlet oak), which the red oak very much resembles.

Quercus tinctoria (dyer's oak, or black oak, or quercitron) is probably a variety of the red oak. It is a native of Pennsylvania and of the mountains of the Carolinas and Georgia, where it becomes a very large tree, with a bark so dark-coloured as to have gained for it the name of black oak. The leaves are large and very handsome, becoming dull red or yellow in the autumn. Its wood is strong, but very coarse. The inner bark abounds in a yellow dye of great brilliancy, which is known in trade under the name of Quercitron.

Quercus circus (live oak), a very valuable species, confined to the southern states of the North American Union,

where it is most abundant in Texas. The live oak yields the best oak of America, the timber being heavy, compact, and fine-grained, and is extensively employed in the American dockyards, although it does not usually acquire a large size. The acorns are sweet.

V. OAKS OF MEXICO.—These are extremely numerous and in many cases form highly ornamental trees.

Quercus Sideroxylla (the iron-wood oak), found in Mexico, near Guanajuato, and in other regions in dry barren places 6000 or 7000 feet above the sea. It forms a large tree of great beauty. Its timber is very hard, takes a fine polish, and is extremely durable when used under ground or when sunk under water.

Quercus macrophylla (large-leaved Mexican oak). This is the finest oak in the world. It inhabits the southern parts of Mexico and Guatemala, and has leaves 12 to 18 inches long, and broad in proportion. Its acorns are as large as French walnuts.

Medicinal Properties of the Oak.—The only part of the tree which is used for medicinal purposes is the bark, which is usually separated in the spring or early summer, that obtained from young stems being the most valuable. A decoction of oak bark is a valuable astringent, effective, safe, and economical. As a gargle it is used in cases of relaxed sore throat; as an injection it is employed in cases of leucorrhoea, proapsus, and indeed in most kinds of discharges. Its efficacy as an injection is increased by the addition of alum. It is also administered internally in cases of bleeding from the lungs, stomach, &c. From the gall-nuts obtained from the *Quercus infectoria*, or dyer's oak, the more powerful astringents, tannic acid and gallic acid, are obtained. One ounce of tannic acid combined with 4 fluid oz. of glycerin forms the useful glycerin of tannin, one of the best applications known for relaxed sore throat and enlargement of the tonsils. It is also wonderfully effective in many affections of the nostrils. Gallic acid is chiefly employed in the form of a powder in cases of internal bleeding. See BARK.

OAK-EGGAR MOTH (*Lasioampa quercus*) is a common English MOTH belonging to the group Bombycidae. The wings of the male are chestnut brown, with a broad pale yellow band running across both wings; about the centre of the fore wings is a white spot. The markings are similar, but paler in the female, which is much larger than the male. The body is stout and hairy, and the antennae of the male are beautifully pectinated. The larva is large, black, and thickly covered with hair. It feeds on various plants in addition to the oak.

OAK'HAM or OKE'HAM, the chief town of the county of Rutland, in England, 12½ miles west by north from Stamford by the Midland Railway, and about 101 miles from London. It had an ancient castle, erected probably by Walcheline De Ferreris, a younger branch of the family of De Ferrars, to whom Henry II. had granted the manor. Of this castle, the county-hall, in which the assizes are held and the other business of the county and the town transacted, is a portion; the remainder is in ruins. The architecture is late Norman or very early English. The town has a neat and clean appearance, many of the old houses having been rebuilt. The church, a large edifice, mostly of Perpendicular character, has a fine tower and spire. It was restored in 1858. Near it stands the school-house of a richly-endowed grammar-school. The railway affords facilities for supplying the town with coal, and for sending corn to the manufacturing districts. There is a good market for corn, and brewing and malting are carried on. The population in 1881 was 3227.

OAK-TREE CLAY, the name originally applied by William Smith to the geological formation commonly known as the KIMERIDGE CLAY.

OAK'UM (Old English, *acumba*, literally "that which is combed out"). When the various cables, stays, shrouds,

ropes, &c., belonging to a ship are no longer of use, they are cut up into pieces, and then pulled asunder by untwisting the strands and rubbing the fibres from each other. In this state the hempen threads are called oakum; and the picking of them is a forced employment in many prisons and workhouses. The oakum is sold to shipbuilders, and by them used for driving into the crevices or seams in the outside or deck of a ship, by the aid of a large mallet and a caulking chisel, to prevent the entrance of sea-water. The filled crevice is afterwards well tared. The whole process is called *caulking*.

OAN'NES, the fish-formed god of Babylonia, with human head and feet, as it were a man with a fish's skin upon his back, was fabled to have arisen from the Persian Gulf, and lived during the day among men, teaching them letters and all the arts, retreating to the waters again at night. He is the reputed author of the vast Chaldean civilization. The great Semiramis was held to have married him before she married Ninus, and from the secrets she thus learned to have derived her great power. The god is frequently figured in the sculptured palace slabs of Konyunjik, &c.

OAR, a wooden instrument by which a boat is propelled through the water. It is used like a lever, the rower's hand being the power, and the water the fulcrum against which the oar presses. The oar rests in the rowlock, and in many cases some device is resorted to to prevent it from slipping. An oar is usually about eight feet long, having at one end a rounded part or handle, and at the other a blade, thin and nearly flat, though often somewhat curved, so as to present a concave surface to the water. The intermediate part between the handle and blade is round or square, and gradually tapers towards the blade. Oars are sometimes made of ash or beech, but the best are those made of Norway fir. The chief difference between an oar and a scull is in its extra length and weight.

OAR-FISH (*Regalecus bankii*) is a fish belonging to the family of ribbon-fishes (Trachipteridae), and order Acanthopterygii. The oar-fish is the largest deep-sea fish known, some specimens taken having exceeded 20 feet long. For this reason it is thought that oar-fishes have given rise in some cases to the stories of sea-serpents. The body is excessively elongated and strongly compressed. The dorsal fin extends the whole length of the body, the anterior twelve spines forming a crest over the head; the anal and caudal fins are absent. The ventral fins are reduced to a pair of long filaments, each having a dilation at the extremity like the blade of an oar. The colour is silvery, with irregular black blotches; the dorsal fin is red. The oar-fish, or "king of the herrings," as it is frequently called, seems to be widely distributed, but living as it does at great depths, it is only rarely that it is taken. On our own coasts a few specimens have been captured, one on the Yorkshire coast being 24 feet long.

O'ASIS is a name applied to a fertile habitable tract in the midst of a barren uninhabited region, an island in the desert, and especially to those small spots in the Sahara and Libyan Deserts where there are springs of water in natural depressions, round which vegetation exists, and where the natives often fix their abode.

OATES, TITUS, the inventor of a terrible fiction, the so-called "Popish Plot" of 1678, was, according to most accounts, the son of a ribbon weaver. He was born about 1620, was educated at the Merchant Taylors' School in London, and at Cambridge, and after receiving ordination became a country curate. In this capacity he served in several parishes, but having brought malicious charges in which his evidence was rejected, he narrowly escaped prosecution for perjury on two occasions. He next became a navy chaplain, but from this post he was speedily dismissed for abominable conduct. Oates now pretended to become a Roman Catholic in order to act as a

spy, and he accordingly conformed to the Roman Catholic Church, and obtained admission in 1677 to the college of the Jesuits at Valladolid. From this he was expelled, but obtained admission to St. Omer at the end of 1677, only to be expelled in the following year. Returning to England, he sought to obtain revenge upon the Roman Catholics by pretending to divulge the secrets of a tremendous conspiracy for the extirpation of Protestantism in England. Among the papers of Coleman, secretary to the Duchess of York, and one of the persons accused by Oates, copies of some letters to Père la Chaise were found, which contained some expressions eagerly seized upon by the public as evidence of the existence of the plot, and when on 17th October, 1678, Godfrey, the magistrate who took the depositions of Oates, was mysteriously murdered, the whole kingdom was thrown into a state of violent excitement. Assisted by some hired perjurers Oates denounced and obtained the execution of several Roman Catholic gentlemen, while he obtained for himself a pension, a bodyguard, and some apartments in Whitehall. Shortly before the death of Charles, the Duke of York won a civil action against Oates, with damages of £100,000, and in default of payment Oates was taken to prison. On the accession of James II. Oates was tried and convicted of perjury, sentenced to imprisonment for life, to be whipped from Aldgate to Tyburn at the cart's tail, and to stand in the pillory at intervals during his imprisonment. It was intended that the whipping should kill him, but though he is said to have received 1700 strokes, to the astonishment of all he survived, and in 1688, after the Revolution, he obtained his liberation and another pension. In 1690 he became a Baptist, but in less than a year was ejected from that body. He died 13th July, 1705.

OATH (Old English, *ath*), an asseveration made under superhuman penalty or sanction. The use of oaths seems to have been common among most ancient nations, and the practice of oath taking on solemn occasions is found prevailing among all peoples which have emerged from primitive barbarism. Among the ancient Hebrews the use of oaths was very common, and there are abundant references to the practice in the Old Testament. In the Mosaic law a man receiving a pledge from a neighbour was required, in case of injury happening to the pledge, to clear himself by oath of the blame of damage (Exod. xxii. 10, 11); and a man suspected of having lost property in his possession was required to vindicate himself in a similar manner (Lev. vi. 3). Sometimes in case of theft the whole community were put upon their oath, and a man who, in the face of this adjuration, preserved silence, was considered to be guilty of perjury (Lev. v. 1; Prov. xxix. 24). An oath having a terrible curse attached to it, also formed part of the ordeal used for the detection of adultery (Num. v. 12-31). In addition to the judicial oaths we find that both in public and private transactions oaths were freely used, and appeals to Jehovah on the one hand, and to heathen deities on the other, are treated as tests of allegiance (Exod. xxiii. 13, &c.) Oaths were also employed both judicially and in ordinary life by the ancient Egyptians, Assyrians, Persians, Greeks, and Romans. The Greeks seem to have sworn chiefly by Jupiter, who was believed to pay special regard to oaths, and this belief, with others, is held up to ridicule in the "Clouds" of Aristophanes. Other forms of oath in which the various gods, the furies, natural objects, &c., were invoked, were also common, and many different formulas may be found in the writings of the classic authors. In keeping with the anthropomorphic ideas common among primitive peoples, the gods themselves in many mythologies were supposed to be bound by oaths, and in the Odyssey we find the hero, when suspicious of the wiles of Kalypso, requesting her to "swear by the solemn oath that binds the gods." There are several references in the Old Testament to the

oath of Jehovah (Num. xiv. 28; Jer. xlv. 26; Isa. lxii. 8, &c.), and the writer of the Epistle to the Hebrews bases one of his arguments expressly on the sanctity of the oath of God (Heb. vi. 16-18).

The forms of adjuration used were very multifarious, but they generally involved some significant and symbolic action in addition to the repetition of a verbal formula, a feature which has been preserved in most forms of oath-taking down to the present day. Oaths were sometimes taken before the altar, the person swearing laying his hand upon the head of the victim, or touching the image of the god while making his promise or declaration. From this practice the custom doubtless arose of swearing by sacred altars or temples, although the swearer was in some other place at the time of taking the oath. A reference to this practice among the Jews is found in Matt. xxiii. 16-22. The ancient form of oath referred to in Gen. xxiv. 2 and xlvii. 29, is generally regarded as containing a principle similar to that of phallic symbolism. A very solemn form of oath was that in which a victim was cut in two, and the two parties entering into the agreement passed between the pieces laid opposite each other, and by this act invoked upon themselves the fate of the divided animal in the event of perjury. In Jer. xxxiv. 18-20 there is a reference to a covenant made with Jehovah, by passing between the parts of a calf thus cut asunder, and in Gen. xv. 9-18 Jehovah is represented as entering into an oath of this kind with the patriarch Abraham. A more simple form consisted in the raising of the right hand or both hands towards heaven. A description of an oath taken in this manner by Agamemnon is given in the Iliad, xix. 254. The Hebrews were also accustomed to take oaths in this form. Abraham, in refusing the offer of the King of Sodom says, "I have lift up my hand unto the Lord" (Gen. xiv. 22); and in the poem entitled the Song of Moses, Jehovah himself is represented as swearing by lifting up his hand to heaven: "For I lift up my hand to heaven, and say, I live for ever" (Deut. xxxii. 40).

The question as to the lawfulness of oaths in Christianity has been debated ever since the days of the fathers. The injunction of Christ to "swear not at all" (Matt. v. 34), and that of James in his general epistle, "But above all things, my brethren, swear not" (v. 12), have always been held by a minority in the church to prohibit all forms of oath-taking whatever. The opinion that has more generally prevailed, however, is that these injunctions refer only to unnecessary and trifling oaths, and do not prohibit the use of the oath in its more solemn and public forms. In support of the latter view, it is pointed out that Christ himself responded to the formal adjuration of the high-priest (Matt. xxvi. 63), and that apostolic practice certainly permitted the use of oaths on solemn occasions (2 Cor. i. 23; Gal. i. 20, &c.). The Quakers, Moravians, Mennonites, and a few other Christian sects, reject all forms of oath-taking at the present day; but the belief and practice of the majority of Christendom is that which is expressed in article xxxix. of the Anglican Church.

In England the law formerly required all evidence testimony for judicial purposes to be given on oath, and the only persons who could be sworn as witnesses were those who, being questioned on the occasion of taking the oath, would declare their belief in the existence of God, in a future state of rewards and punishments, and who would further declare their belief that perjury would be punished by the deity. At the present time Quakers, Moravians, and Separatists are allowed to make affirmation instead of taking oath in all legal and civil matters, and by the Evidence Further Amendment Act of 1869 (32 & 33 Vict. cap. 68) all witnesses in a court of justice are allowed to substitute an affirmation in the place of the usual form of oath. The penalty for making a false declaration is the same as that imposed in cases of perjury. A Jew, a Mo-

hammedan, or a Hindu may be sworn as witnesses, but they must severally take the oath in the form which is sanctioned by the usage of their country or nation. Thus Jews are sworn on the Pentateuch, keeping their hats on, and invoking Jehovah; Mohammedans are sworn upon the Koran; and Chinese have been sworn by the ceremony of 'breaking a saucer upon the witness box.

An oath is required in England in many cases besides judicial proceedings; as, for instance, on admission to places of high public trust, on entering the army, the navy, or the volunteers, &c. Formerly persons entering Parliament were required to take the several oaths of allegiance, supremacy, and abjuration, but in modern times a single parliamentary oath was substituted for the three, and this has been altered in its form so as to enable it to be taken by Roman Catholics and Jews. A Quaker, Moravian, or Separatist elected to Parliament is allowed to affirm instead of taking oath; but it was held in the case of Mr. Charles Bradlaugh, elected for Northampton in 1880, that this right did not extend to other persons. In addition to the oath of allegiance the chief officers of state have to take what is called the official oath, by which they swear that they will well and truly serve their sovereign in the office upon which they are entering. An oath of fidelity to the laws of the realm, to justice in their administration, and to the maintenance of Protestantism is also administered to the sovereign by the archbishop at the coronation.

In Scotland the law in relation to oaths is, generally speaking, much the same as in England. In some respects, however, differences may be traced. In Scotland witnesses are always sworn by the judge, and never by the clerk of court. They are not required to kiss the book, or do any more than repeat the words of the oath, with the right hand held up. Any witness objecting from conscientious motives to take an oath is allowed to substitute an affirmation, in terms of the Affirmation (Scotland) Act, 1865, 28 Vict., c. 9, violation of which entails the pains and consequences of perjury. There remain also in Scottish law some peculiar forms of oath, derived probably from the canon law, but now obsolete in most other European systems. These are (1) the Oath in Supplement, a procedure by which when a *semi-plena probatio* had been made out the plaintiff could depone in addition, and thus bear it up to a *plena probatio*. The recent legislation allowing the parties to an action to be examined *in causa* has in practice abolished the oath in supplement. (2) The Oath of Calumny. In order to prevent calumnious and unnecessary suits the Act of 1429, c. 125, ordained both parties at the beginning of a cause to swear by themselves or their counsel that the facts set forth by them were true. At present this oath is almost in disuse, unless in consistorial causes. In actions of divorce it is still required of the plaintiff to guard against collusion. (3) Oath of Reference. In any civil cause either party may refer the matter in dispute, or any part of it, to the oath of his opponent. He may do this at any time down till final judgment; but this mode of procedure is merely equitable, and the court has accordingly a discretionary power to refuse it if in their opinion to grant it would not serve the ends of justice. Reference to oath is still quite common in Scotland.

The Acts 37 Geo. III. c. 123 and 52 Geo. III. c. 101, made it felony punishable by penal servitude to administer treasonable and unlawful oaths.

OATS (from the Ang.-Sax. *ata*, which conveys the idea of food). [See AVERN.] The great use of oats, and the ease with which they are raised on almost every kind of soil, from the heaviest loam to the lightest sand, have made them occupy a place in almost every rotation of crops. Of all the plants commonly cultivated in the field, oats seem to have the greatest power of drawing nourishment from the soil, and hence are justly considered as

greatly exhausting the land. Some farmers on this account prefer buying all their oats in the market to raising them on their own land. Where the soil is well adapted to the growth of wheat and barley, which bear a better price, this may be a judicious plan; but with proper management, a crop of oats may give as great a profit on the best land as any other crop, as it requires less manure and produces an abundance of straw.

In the year 1885 there were 1,328,000 acres of oats grown in Ireland, 1,050,000 acres in Scotland, and 1,648,000 acres in England. This extent was more than nine times that of wheat in Ireland, and about thirteen times that of wheat in Scotland; while in England it was not quite half the area devoted to wheat. Taking the kingdom as a whole, oats have the largest acreage of all corn crops appropriated to them. This is accounted for by the colder climate of the two former countries.

The best oats are raised in Scotland and in Friesland, and in both countries the land is carefully cultivated. In Scotland oats are generally sown on a grass layer which has been in that state for some years, and sometimes on old pastures, which are broken up for the purpose. The crops exceed in bulk and weight of grain all that the most sanguine person, unacquainted with the system, would expect, and in many seasons not favourable for the wheat crop oats are much more profitable. Wherever the land is not of a good quality and wheat is apt to fail, oats are a safer crop, especially in retentive soils, as rye is on poor sands.

When oats are sown after turnips, cabbages, or any other green crop, the land should be well ploughed, if the green crop was not consumed on the spot, and a moderate supply of manure will be well repaid by the increased produce. A heavy loam is best suited for oats; they require a certain degree of moisture, and a deep soil is very favourable to their growth. When oats are sown after artificial grasses, the land is seldom ploughed more than once, and the seed is sown on the fresh mould which has been turned up; but unless the land be very free from weeds, it would be better to plough the sward with a shallow furrow early in autumn. Before winter the scarifier would break the rotten sward, which might then be buried deep by another ploughing. The land would be ready for sowing early in spring, which is a great advantage, both as to the quality of the oat crop and the earlier harvest, especially in those districts where the latter part of the autumn is apt to be stormy and rainy. The land thus treated would be clean, and the fallow, which is often resorted to of necessity after a crop of oats, might be dispensed with, as the weeds have been destroyed.

When oats are sown on light land after turnips which have been eaten by sheep folded on them, it may be ploughed with as shallow a furrow as will turn in the surface: the preparation for turnips will have sufficiently moved the soil; and the manure of the sheep should not be buried too deep. On poor moist land oats are more profitable than barley. Clover and grass seeds may be sown among them with equal advantage, as they will seldom grow so high as to be laid and smother the young clover; and barley is very apt to fail on land subject to retain the water.

In sowing oats more seed is often used than of any other grain, because, though the plants tiller where they have room, the straw of the second shoots is weaker, and the grain is not ripe so soon as that of the principal stem; but when the plants rise close and thick, there are no tillers, the main stem is stronger, and the corn is more plump and equal. Six bushels of oats are often sown on an acre; but if they are drilled, four bushels are sufficient, and when dibbled, which is sometimes the case in Norfolk and Suffolk, much less seed is used.

Oats, when fully ripe, are very apt to shed, and many are lost for want of attention. As soon as the straw turns yellow under the panicle the oats should be reaped, however green the lower part of the straw may be; and that restored

will be better fodder for cattle, and all the corn will be saved. Oats should be reaped, like wheat, close to the ground, and tied in sheaves; this may be done perfectly by machinery. The produce of an acre of oats varies from 4 to even 12 quarters.

In some countries the oats are given to horses in the straw, without thrashing them; and where the quantity can be regulated the practice is good. The horses masticate the corn better in the chaff, and the straw is wholesome; but where horses do hard work, they would be too long in eating a sufficient quantity, and it is better to give them oats thrashed and cleaned, with clover hay cut into chaff. When hay is dear, it is often cheaper to increase the quantity of oats, and to give it with wheat-straw cut fine. In this way very little hay is required. The calculation is easily made when we consider that a pound of good oats gives as much nourishment to a horse as 2 lbs. of the best clover or sainfoin hay. A truss of hay of 56 lbs. is therefore equal to 28 lbs. of oats, or a bushel of the best oats will go as far as one truss and a half of hay. Oats ground into a coarse meal form a considerable portion of the food of the labourers and many men of the middle ranks of life in Scotland, Ireland, and the north of England. The meal is simply stirred into boiling water with a little salt until it becomes of the consistency of a hasty pudding; it is then called porridge, and when eaten with milk or sugar makes a wholesome and palatable food. The meal is also made into cakes. Oats deprived of the husks or decorticated (*gratum*), are employed under the name of sugar or grits to form with water the *Decortian armar*, or water-gruel. When bruised, ready for use, they are denominated Embden grits, or prepared or patent groats or grits. A greater or smaller quantity of these are to be used to a pint of water, according to the object in view. When employed for an article of nourishment, the gruel may be made thick; when required as a demulcent or diluent, to promote perspiration at the commencement of a cold, it should be thin; and the addition of butter, spices, and wine, or anything save a little salt and sugar, is to be avoided. This is regarded as a light and digestible article for invalids. With some it readily produces heartburn, and the same objection is urged against oatmeal, whether eaten in the form of oat cakes or employed to form porridge. The husks are frequently steeped in water for a few days, and then drained off. The liquid when boiled stiffens into a dish called sowens in Scotland. This is slightly acid, and forms with milk a favourite food of the peasantry for supper. The quantity of oats imported into the United Kingdom varies much less than wheat—being generally from 10,000,000 to 13,000,000 cwt. per annum, valued at about £5,000,000 sterling. The largest supplies are received from Sweden and Russia. The imports in 1885 amounted to 13,061,811 cwt., valued at £4,252,135.

OBADIAH, BOOK OF. the fourth and smallest of the works of the minor prophets, according to the arrangement of the books in the Authorized Version. The name Obadiah (i.e. servant of Jehovah) is a common name in the Old Testament, but it is impossible to connect the author of this oracle with either of the persons bearing this name mentioned elsewhere, and we know nothing of him except what may be gathered from the book bearing his name. His oracle is directed chiefly against the Edomites, and it was probably delivered soon after the sack of Jerusalem by Nebuchadnezzar. The Edomites are denounced as treacherous and cruel neighbours, people who from their kinship ought to have been friends, but who had shown themselves enemies. When Jerusalem was taken they had rejoiced at its destruction, had assisted to plunder it, and had laid in wait to cut off the fugitives who sought to escape through their borders. The prophet warns them that the day of Jehovah is at hand, and declares that they shall be as stubble, and that restored

Israel shall be as a flame before which they shall be utterly consumed.

The first nine verses of the oracle agree so closely with Jer. xlix. 7, &c., that it is evident that the two passages cannot be independent; but it is impossible to say whether one passage is copied from the other, or whether both prophets use an earlier and an anonymous oracle.

O'BAN, meaning in Gaelic "the little bay," a town of Scotland, in the county of Argyll, situated on the sea-coast, 136 miles W.N.W. of Edinburgh, with a population of 3991 in 1881. The railway from Oban to Callander, opened in 1880, passes through some of the finest scenery in Scotland. The chief importance of the town arises from its convenient position as a centre for tourists to the West Highlands, for while it has direct communication with Edinburgh and Glasgow, it is a port of call for most of the coast steamers. But though this is the main source of its prosperity, the beauty and interest of its surroundings, its almost landlocked bay with deep water up to the pier, protected by the island of Kerrera from storms, and its healthy soil and pure air are rapidly bringing it into favour as a seaside resort. The houses along the bay have a remarkably fine appearance, backed as they are by rising heights and consisting chiefly of hotels, which for architecture rival many of the best of larger towns. These, a court-house, the parish church, another Established church, a Free church, a United Presbyterian church, an Episcopal church, a Roman Catholic pro-cathedral, and some of the banks, are the most important edifices. The Royal Highland Yacht Club has its headquarters here. The town is governed by a provost, two bailies, and six councillors. The most interesting ruins in the vicinity are those of Dunstaffnage Castle, the seat of government of the Scots until 850. The Coronation Stone now in Westminster Abbey was taken hence to Stone.

O'BANG, a Japanese coin of the older, purely native, money. It was of gold, of a rounded oblong shape, and was worth 100 itziboo; therefore equal in value to about £6 13s. 4d. of our money.

OBLIGATO, a musical term, implying that the instrument whose part is thus marked out in any particular composition cannot be omitted. A piece with "flute *obligato*" means that the flute must really be employed, and that the composer's ideas cannot otherwise be fully developed.

O'BEAH, OBE, or OBI, the name given by the West Indian negroes to a peculiar species of witchcraft or pseudo-magic which appears to have been imported from Africa, and is usually practised by negroes of African birth. It is strikingly similar to the superstitions of mediæval Europe, and closely connected with the art of secret poisoning. The Obeah man or woman is always an adept in the preparation of poisonous potions, charms, and spells; will procure the death of a person whose waxen effigy wastes away under their hands; but from his or her acquaintance with the properties of herbs, will often effect a cure in dangerous diseases when the sufferers have been given up by the regular practitioners.

OBEID, or EL OBEID, is the capital town of Kordofan in Central Africa. It stands in an extensive plain 1700 feet above the sea, and is almost entirely built of mud or reeds, in several detached portions. There are five mosques. It exports slaves, gold-dust, silver, ivory, hides, gums, &c. The population is estimated at from 12,000 to 20,000. It was in an attempt to relieve the Egyptian garrison of El Obeid that Hicks Pasha and his army were annihilated by the followers of the Mahdi in 1888.

OBELISK. Among the most impressive of all human monuments are those vast Egyptian monoliths which the Greeks named "needles" (*obeliskos*), from the same analogy which gives their name to the Needles of the Isle of Wight. The Arabs still call obelisks *meselleh* (needles) to this day. The old Egyptian name for them is *tekni*.

The meaning of obelisks is primarily religious. They are religious monuments, erected in commemoration of and in gratitude for the splendour of the magnificent monarchs who were their authors. They were nearly always dedicated in pairs, and formed the external ornaments of the temples, standing one on each side of the propylon or massive entrance gate. The oldest obelisk of which the date is accurately known is that of Usirtesen I., a Pharaoh of the twelfth dynasty, reigning about 2360 B.C. This obelisk still stands in its original position at Heliopolis, about 8 miles from Cairo, and is now to be found in the midst of a flourishing plantation of sugar-cane. Those which are supposed to be older than this have no inscriptions, and therefore their date cannot be really fixed. The great value and durability of obelisks, the impossibility of any one but the monarch himself erecting them, the ready permanence they afforded to inscriptions legible to all time, marked them out as the royal monuments *par excellence* in the conservative, religious, art-loving land of Egypt.

Obelisks have many features in common. They are all, but one or two, hewn from the rose-coloured granite at Syênê (Assouan), where the mountains cross the path of the Nile at the First Cataract. They are all of the same general shape, namely, four-square in section, pyramidal in elevation, tapering slowly to near the top, and then breaking off with a much sharper angle, which quickly brings all four sides to an apex, the quickly sloping termination being called *pyramidion*. They all have a height of somewhere near ten times the side of the base, measuring the shaft only, exclusive of the pyramidion. They are all (save nine) sculptured with hieroglyphics in the Egyptian fashion of what has been happily called sunk-relief, or in simple intaglio; and the lines of hieroglyphics are always read vertically. But, nevertheless, they possess most characteristic differences among themselves. Their height and weight are very various, as may be seen from the subjoined table.

LIST OF PRINCIPAL EGYPTIAN OBELISKS.

	Height.		Thickness at Base.		Weight.
	Ft.	In.	Ft.	In.	
Lateran (Rome),	05	6	av. 9	5	455½
Queen Hatshepu (Karnak),	97	6	7	10	331½
Assouan (in the quarry),	95	0	11	1½	686½
St. Peter's (Rome),	83	1½	8	10	321½
Luxor (Egypt),	82	0	8	2½	253½
Piazza del Popolo (Rome),	78	6	8	0	234½
Luxor (Paris),	74	11	7	11	222½
Thothmes I. (Karnak),	71	7	6	1	154½
Monte Citorio (Rome),	71	5	7	11	253½
Cleopatra's Needle (N. York),	69	6	av. 7	9	200
Cleopatra's Needle (London),	68	5½	av. 7	9	186½
Heliopolis,	67	0	av. 6	2	121
Constantinople,	55	4	7	0	133½
Piazza Navona (Rome),	54	3	4	5	52½
S. Maria Maggiore (Rome),	48	5	4	3	45½
Quirinal (Rome),	45	0	4	2	42½
Trinità de' Monti (Rome),	43	6	4	3	40
Begir (Crocodylpolis),	42	9	av. 5	0	53½
Prioli,	35	0	5	10	52½
Philæ (sandstone),	33	0	5	10	49½
Monte Pincio (Rome),	30	0	3	11	14½
Corfe Castle (England),	22	1½	2	2	5½
Pantheon (Rome),	20	0	2	7	6
British Museum, two (broken),	19	9	2	4	5½
Thothmes III. (Karnak),	19	0	3	6	10½
Piazza Minerva (Rome),	17	7	2	6	5
Boboli Gardens (Florence),	16	1	2	5	4½
Catania (Sicily),	12	4	2	2	8½
Thebes (Egypt),	11	0	2	2	8

The height even differs in those obelisks which originally formed pairs. (Thus the Luxor obelisk now in Paris, being shorter than its mate, was accommodated in its original position at Luxor with a taller pedestal, and was placed nearer the temple, so that to the advancing spectator the height of the two would seem the same. This was felt by the ancient Egyptians to be preferable to shortening the longer stone, and the mode of quarrying rendered it not possible to be quite sure beforehand as to the size of the stones.) Their inscriptions of course differ according to their purpose and their authors, and not seldom one obelisk bears lines of hieroglyphics due to sovereigns of widely separated epochs. Their age possibly ranges from the extremely early fourth dynasty, called the "pyramid builders" (3124 to 2810 B.C.), to the Roman Conquest, only half a century before our era. Further, the general proportions above given are not at all exactly kept. The adjacent sides of the shaft are frequently unequal, though the opposite sides are always equal, but the difference is never so large as to be noticeable by the unaided eye. Also the ten-base proportion of height is not accurately observed. Sometimes the entire shaft was gilt, though no traces of gilding remain; but the fact is recorded on the monuments themselves, and in documents of which there is no doubt possible. Even when not gilt all over they were usually crowned by a gold cap, covering, or partly covering, the pyramidion; but it is needless to say that though traces of the fixing are sometimes found, the gold itself has long since disappeared.

In describing an obelisk in detail one can hardly do better than take a familiar example. Accordingly the Plate illustrative of this article represents Cleopatra's Needle, easily accessible to all in its position on the Thames embankment at London. This is a large specimen, ranking tenth in weight and eleventh in height of the whole list. It is fairly preserved, though its long protection by burial in the sand, where it lay for many centuries after it fell till it was dug out and brought to England in 1877-78. It was originally capped with solid gold, but no gold now remains. It comes, like the rest of the obelisks, from the rose-coloured granite quarries of Sy  n   (Assuan), in Upper Egypt. Its full height, to the summit, is 68 feet 5½ inches, and at the base it measures 7 feet 5 by 7 feet 10½. From this it tapers up to 4 feet 10 inches on the smaller faces, and 5 feet 1 inch on the larger faces; and thence sharply runs up to the apex of the pyramidion, which is 7 feet 6 inches in perpendicular height. The whole stone weighs over 186½ tons. The powerful Pharaoh Thothmes III., the grandest monarch of the eighteenth dynasty, brother and successor of the extraordinary queen-regent Hatshepshu, erected both this and its companion at Heliopolis, and the centre line of hieroglyphics on each face was carved by him about the date 1540 B.C. It is an invocation to the gods, a recital of his own grandeur, his victories, his magnanimity, his merit in erecting this monument and other reverend works, and the hope of long life and prosperity in which he consequently indulges. There are two added side-lines of hieroglyphics on each face, sculptured after the monument was in position by a later Pharaoh, the renowned Ramses II., or "the Great," the most splendid prince of the nineteenth dynasty, about 1360 B.C. Both sovereigns are spoken of in the article EGYPT, and were the most distinguished of that part of Egyptian history especially dignified with the name of the Empire. On the side shown in the Plate, reading perpendicularly from top to bottom, Thothmes' central inscription runs thus:—"The kingly Horus, strong bull, wearing the crown of Thebes, and king of Upper and Lower Egypt, Ra-men-Kheper ("sun-creator of the world," a pr  nom  n of Thothmes). He (Thothmes) made this monument to his father, Horemakhu ("sun of the two zones"); he erected two very great obelisks, capped with gold, in honour of his loving (divine) father. He did this, Thothmes, son of the Sun,

beloved of Horemakhu." Ramses' inscriptions run as follows. Left side column:—"The kingly Horus, strong bull, son of Tum, king of Upper and Lower Egypt, Ra-ousher-ma-Sotep-en-Ra ("sun, guardian of justice, preferred of Ra," a pr  nom  n of Ramses), lord of diadems, protector of Egypt, chastiser of the nations, son of the Sun, Ramses Meriamen, easter down of peoples unto the Indian Ocean on the East, and to the Mountains on the West that prop the sky, lord of the two kingdoms, Ra-ousher-ma-Sotep-en-Ra, son of the Sun, Ramses Meriamen, whose looks cherish like the sunbeams." The right side column:—"The kingly Horus, strong bull, beloved of Ma (truth), king of Upper and Lower Egypt, Ra-ousher-ma Sotep-en-Ra, ruler of periods (of thirty years each), like unto Ptah Totnen, his father, son of the Sun, Ramses Meriamen, strong bull, like unto the son of Nu; against whom none of his day can stand up, lord of the two kingdoms, son of the Sun." The other faces contain inscriptions in a similar style.

The power to cut obelisks was obtained by the Egyptian monarchs by the even texture of the Sy  n   rock, which permits huge flakes of 60, 70, and 100 feet to be split from it. The happy chance of an unfinished obelisk remaining in the quarries *in situ* has exposed the whole contrivance, three of its sides being cut and squared, while the obelisk still adheres to the parent rock on the fourth (under) side. The shaft was cut out horizontally. The line marking the edge of the obelisk being channelled out, and holes being sunk along this line, wedges of very dry wood were driven tightly into the holes, and the groove then filled with water, which, causing the wedges to swell, gradually pressed the stone with a gently increasing pressure, growing at last sufficiently strong to burst it from the parent rock. Sometimes the Indian method (still in use in India) may have been used, in which case fire and not water is the agent—fire being lit along the groove of separation, and then cold water poured upon the hot expanded rock. Of course many failures would occur, but under the ancient magnificence of despotism not much heed was paid to that. Once a successful shaft, torn off in this manner, it was moved on rollers to the lowest point of the quarry, purposely kept below Nile-level; then when it was firmly rested there upon barges and well secured, the water was let in, and the obelisk on its barges floated out on the great river, and was carried down to its destination. Probably it was carved and decorated before it was erected; but not necessarily so, as we see in the case of the additions of Ramses on our own obelisk.

Many of the Egyptian obelisks were removed to Rome when the Romans became masters of Egypt, the first removals taking place in the reign of Augustus. The four Roman obelisks due to the munificence of this prince are those now in the Piazza del Popolo, in the Monte Citorio, on the Quirinal, and behind the Church of Santa Maria Maggiore. Rome now possesses twelve obelisks, out of a much larger number once owned by her, many of the smaller ones having perished. The largest is that of the Lateran, which is 105½ feet high without base (although it has been reduced from probably over 108 feet, a portion of the lower part having been cut off in consequence of its being fractured), two of the sides measuring 9 feet 8½ inches at the base, the other two being 9 feet, and the weight of the whole being, in round numbers, about 455½ tons. This obelisk was first conveyed from Heliopolis to Alexandria by Constantine, and by that emperor's son, Constantius, brought from the latter city to Rome, where it was erected in the Circus Maximus. It afterwards fell and broke into three pieces. It was repaired in 1588, and raised in its present site by Pope Sixtus V. It is attributed to Usirtesen I. (2360 B.C.), and a representation of it, with a translation of one face of hieroglyphics, will be found in the article EGYPTIAN ARCHITECTURE. The fine obelisk now in the square of St. Peter's at Rome was

brought to Rome from Heliopolis by the Emperor Caligula (Caligula) early in the first century, and used to decorate his circus. There it remained for fifteen centuries, and was the only one not overthrown during the dark ages. It was removed to its present site at the bidding of Pope Sixtus V. by the famous engineer Domenico Fontana in 1586. He lowered it by pulling it down on one side of its base as a hinge, duly supporting the weight when it began to turn by quantities of rope stays behind, which kept it from falling. It was erected in a similar way. The Pope and his whole court attended at both the lowering and the re-erection of the obelisk, and aided it by their prayers, deep silence being preserved during the actual operation. Among the other obelisks of Rome that call for special notice are the Flaminian obelisk, 78½ feet high, originally raised by Ramses II., brought to Rome and erected, by the orders of Augustus, in the Circus Maximus. In 1589, under Pope Sixtus V., it was repaired by Fontana, for it lay in three pieces when it had been thrown down, and was re-erected in the Piazza del Popolo, where it now stands; the obelisk of Psammetik II. (n.c. 594), transported to Rome by Augustus, who caused it to be erected in the Campus Martius, and adjusted as a gnomon by the mathematician Tacundus Novus. This now stands in the Piazza di Monte Citorio. It was overthrown by Robert Guiscard in 1084, and lay on the ground in five pieces, sometimes buried under rubbish, till Pius VI. in 1792, at great trouble and expense, caused it to be restored and re-erected in its present position.

The obelisks of the Pantheon and the Piazza della Minerva were once a pair decorating the temple of Isis at Rome, probably brought there from Egypt in Domitian's reign. Bernini put them up very tastelessly in 1667. The obelisk now in the Piazza Navona was cut at Syène by the orders of the Roman Emperor Domitian, and in that sense is not an Egyptian work.

Napoleon I. desired to procure an obelisk for France in remembrance of his Egyptian campaign, but never succeeded in accomplishing his design. His successor Louis XVIII., however, continued the negotiations, and obtained from Mehmet Ali the gift of the Alexandria obelisk, that one of Cleopatra's Needles which still stood erect. But the gift was afterwards changed by King Charles X., on the petition of Egyptologists, for one of the more perfect obelisks of Luxor. All arrangements were made under Charles X., but carried out under Louis Philippe. This obelisk is the smaller of the two which originally stood before the propylon of the temple at Luxor, and is about 76 feet high, and 8 feet wide on the broader sides of its base. Its removal was commenced in 1831, under the direction of the engineer Le Bas, and it arrived safely at Paris 28th December, 1833. It was not till 25th October, 1836, that all the preliminary arrangements had been completed. On this day the obelisk was reared by rope-tackle, very much on Fontana's principles, in three and a half hours. The entire cost of the removal was not much less than £100,000.

When, therefore, in 1877, Mr. John Dixon, the engineer, undertook to bring Cleopatra's Needle from Alexandria to England for £10,000, it was felt that this was a very moderate sum. In reality, however, it cost £11,500, and £2000 salvage in addition, so that Mr. Dixon lost £3500 by his undertaking. The "Needle" was one of a pair which Thothmes III. erected at Heliopolis, and to which Ramses II. added inscriptions. When Cleopatra began the great palace of the Cæsarium at Alexandria, in honour of Julius Cæsar, she ordered this pair to be brought from Heliopolis to Alexandria. They were set up by the Romans in 22 B.C., eight years after the queen's death, but nevertheless were called Cleopatra's Needles. One of them fell during the dark ages, and lay for centuries in the sand. Abercromby's army claimed the fallen obelisk in

801 as a spoil of war, and subscribed to bring it home to commemorate the surrender of the entire French army in Egypt, whither Napoleon himself had led it. The difficulty of the task delayed operations till further political complications rendered it impossible. The monolith lay eighteen years unclaimed, and then, in 1819, Mehmet Ali, the sycery of Egypt, desiring to conciliate England, presented it formally to the Prince Regent. The gift was graciously accepted, and the obelisk belonged thenceforth to us. But no steps were taken to bring it home. There it lay, and tourists clipped its edge with their hammers, to bring away memorials—vandalism, the scars whereof exist to this day. Even the erection at Paris of the Luxor obelisk, in 1831, could not wake up the government to the value of their prize. At last, in 1877, the private munificence of Mr. Erasmus Wilson provided the sum necessary to bring the obelisk to London—an everlasting honour to himself and disgrace to our rulers. As said above, Mr. Dixon undertook the task. His plan was bold and novel. He encased the obelisk in an immense iron cylinder, 92 feet long and 15 feet in diameter, fitted with keelson, rudder, and mast, and bearing a sort of deckhouse above, where one or two sailors might be stationed. The ship *Cleopatra*, as this construction was called, was towed all the way by a steam-tug. A great storm came on in the Bay of Biscay, 14th October, 1877, and after six seamen had perished in their attempts to save the *Cleopatra* (their names are all duly recorded on the base of the obelisk, it is said by request of the queen herself), she was cast adrift, and when the storm abated could no longer be found. Another vessel found her, towed her into Plymouth, and claimed enormous sums for salvage. After proceeding to law, the salvage crew were awarded £2000, certainly a handsome remuneration. Then came the "battle of the sites," many various positions being advocated. Finally, the Thames Embankment was selected. The *Cleopatra*, now lying in the Thames, was brought alongside and the obelisk landed. It was then supported by an iron jacket round the middle, the jacket being lined with wood, and being sufficiently long (22 feet) to prevent the weight of the ends of the obelisk from breaking it asunder. The jacket bore two trunnions or turning pins projecting from its sides. The obelisk was now gradually raised by suitable machinery, still in the horizontal position; and after each raising it was supported by suitable staging. When its centre was sufficiently elevated the trunnions were supported, the head and foot were freed, and suitable tackle, fore and aft, swung the obelisk from the horizontal to the vertical position in half an hour, 12th September, 1878. The long burial in the sand has certainly rather preserved the stone than otherwise. It is still a source of anxiety how this magnificent stone will stand the disintegrating power of our climate.

Fired by this success, the United States induced the Khedive of Egypt to give them the companion obelisk, the still standing Cleopatra's Needle. Mr. W. H. Vanderbilt, the millionaire (whose colossal fortune was the world's wonder at his death in December, 1885), was ready to defray all expenses. Mr. Dixon, who was applied to, estimated the cost at £20,000; whereupon Lieutenant Goringe, of the United States navy, offered to do the work for £15,000. But in the event Mr. Vanderbilt paid 103,732 dollars (about £20,746), and of this not more than £230 was for Lieutenant Goringe's own expenses. Lieutenant Goringe had to get his obelisk down, and it was so firmly clamped to its base by the old Roman architect of n.c. 22 that he had great trouble in freeing it. He encased it from end to end in wood, put a jacket with trunnions round its middle, following Dixon's plan, raised it from its seat so as to free the heel, and then swung it to the horizontal, 6th December, 1879. Here he caught it upon two great stacks of timber, in the midst of each of which was a small

ram. Alternately lowering his stacks and leaving the obelisk supported by the ram, and then lowering the obelisk to the lower level of the stack, he got it safely down in a fortnight. The weight is 200 tons, so that great care was needed. It was carried across to New York in the hull of the steamer *Dessoug*, and arrived safely 20th July, 1880. The original stones for the base were brought from Alexandria, and laid (September, 1880) with great ceremony by the entire body of Freemasons. The actual turning of the obelisk, which was a reversal of the process of lowering, took five minutes only, and was accomplished on 22nd January, 1881.

There are thirty-six Egyptian obelisks known. (This list of course excludes the Roman gray granite obelisk at Arles, cut from the neighbouring rock.) Of these twelve are in Rome and four elsewhere in Italy; six in England, one in New York, two in Paris, and two in Constantinople.

See Birch's "Notes on Obelisks" in the *Museum of Classical Antiquities* (vol. ii., 1862), Cowper's "History of Egyptian Obelisks" (London, 1877), and Erasmus Wilson's "Cleopatra's Needle" (London, 1877); also the splendid large quarto on "Egyptian Obelisks" by Goringe (London, 1885), which has numerous and accurate representations of the chief examples.

OBERAMMERGAU, a village of Upper Bavaria, about 45 miles from Munich. It is only worth notice as the scene of the Passion Play which takes place every ten years in consequence of a vow made when a plague was raging in 1638.

O'BERLIN, JOHANN FRIEDRICH, the celebrated pastor of the Ban-de-la-Roche, was born at Strasburg, 31st August, 1740. His father, an able professor in the gymnasium of that city, educated him with a view to his entering the army; but the young man ultimately preferred the work of the church, and at the age of twenty-seven accepted the Protestant pastorate of a wild, mountainous district of Alsace. This district had suffered greatly in the Thirty Years' War, and the few inhabitants that remained were sunk in the most abject ignorance and misery, so that the first efforts of Oberlin to improve their condition only aroused their stupid and malevolent opposition, which on more than one occasion threatened his life. A strong-willed, clear-headed, and courageous man, he was not to be daunted by opposition, however; and directing his attention at first to the young, he succeeded in erecting a school-house in every district of his parish, and in furnishing the schools with teachers qualified by his own assiduous instruction. He also prevailed upon the peasants to adopt some improved methods of cultivation, introduced better seeds, and himself shouldering a pick-axe, he led the way for the opening up of a road to Strasburg, the nearest market-town. In the end he gained a complete moral ascendancy over his rude parishioners, over all of whom he maintained a close supervision. During the Revolution, when public worship was forbidden by the Convention, he conformed to the letter of the law, styled his church a club, and being unanimously elected public orator, was enabled to continue his ministrations unmolested. A sincere Protestant, he was free from bigotry and intolerance, and he lived on the best of terms with his Roman Catholic neighbours. In 1818 the Royal Agricultural Society of Paris voted him its gold medal, and in 1819 he was nominated for the Legion of Honour. After a pastorate of fifty-nine years he died at his post of duty, 1st June, 1826. The success of his labours for the material improvement of his flock is shown by the fact that although the population of the district was only 500 when he entered upon his labours, it had increased to 5000 at the close of the century.

See "Brief Memorials of Oberlin," by Rev. T. Sims, M.A. (London, 1830), and "Memorials of Oberlin, with a Short Notice of Louise Scheppler" (London, 1838 and 1862).

O'BERON (a modified form of Alberon, that is, Alberich, the ancient elf-king of Teutonic mythology), king of the Fairies and consort of Titania. Oberon is first used as the name of the king of Faery in the mediæval romance of "Sir Huon of Bordeaux," whence Greene probably took it in his "James IV.," its first use in English. Spenser, Shakspeare, and others of Greene's contemporaries borrowed it. Weber's opera of "Oberon" is on a considerably modified version of the old romance.

OBESITY or CORPULENCE is the term used to denote an excessive development of fat in various parts of the body. The average quantity of fat in healthy men is about one-twentieth of the weight of the whole body, but in extreme cases one-half or even four-fifths of the total weight may be fat. Obesity may occur at all ages; it is not uncommon in children, it is far more rare in youth and in the early periods of manhood, and is most common after the age of forty, at which time an increase in the quantity of fat is observed in perhaps the majority of persons. In the case of men it is usually partly attributable to the fact that after the age of forty less muscular exercise is taken, and the pleasures of the table become more attractive; while in women the cessation of ovulation at the change of life induces changes which tend remarkably to the deposition of fat. Excessive corpulence is more common among women than among men, and this difference is especially marked in the obesity which is developed after the middle period of life. The chief accumulations of fat take place beneath the muscles, in the omentum and mesentery, about the heart, on the chest, the back of the neck, and under the chin. In all these parts a certain quantity of fat naturally exists, and here, therefore, its amount is merely increased; but in cases of excessive obesity it accumulates in situations where before there was none, as among the minute fibres of the muscles, even those of the heart, and in various other tissues. It is noteworthy, however, that some portions of the body, such as the cydils, wrists, and ankles always remain free from fat. Of the internal organs it is generally found in the case of very corpulent persons, that the heart and liver are large and infiltrated with fat, the stomach large and well developed, as is also the pancreas, but the lungs and the kidneys are usually small.

Some well-authenticated cases of enormous obesity are preserved in medical records. The most noteworthy is that of the celebrated Daniel Lambert, who at the age of twenty-three weighed 32 stone, and was then able to walk from Woolwich to London, but who afterwards reached the unwieldy weight of 52 stone 11 lbs. His height is not recorded, but as the normal weight of a man 6 feet high should be about 178 lbs., he may be safely said to have weighed more than four tall men of average bulk. Among other cases may be mentioned those of Edward Wright, who weighed 44 stone, of a girl who weighed 13 stone at the age of twelve years, and of a boy who at three years of age weighed 8 stone 12 lbs.

Considered as a bodily condition it is impossible to define the exact line where obesity must be considered as a disease. A moderately stout person may enjoy good health and suffer but little disturbance of function on account of his corpulence, but there is no doubt that excessive obesity is really a disease, and by the impairment of the muscular powers of the body which it causes, and its interference with the circulation, it may lead to premature and sudden death. Very fat people rarely reach an advanced age, and they are especially prone to catarrh of the respiratory and alimentary mucous membranes. Where obesity causes death the immediately exciting cause is usually either failure of the action of the heart, or from apoplexy caused by rupture of an atheromatous vessel in the brain.

With respect to the treatment of obesity it may be

observed that the use of vinegar after meals, or of any of the quack nostrums advertised as cures for corpulency, is usually attended by serious injury to the digestive, and often to the urinary organs. Soap was formerly much employed in combination with milk and lime-water, and its use was strongly advocated by Dr. Fleming, whose treatise on corpulency was published in 1760, but it was found by experience to exert marked prejudicial effects when taken for a prolonged period. Iron has always exerted a satisfactory influence in cases of obesity associated with anæmia, the tendency to the deposition of fat caused by this condition diminishing as the system comes under the influence of the drug, while the general health is also improved. Its use, however, is not indicated in those forms of obesity which arise from other causes. Iodine in some of its forms has undoubtedly the power of reducing fat, but this reduction is not always followed by an improvement in health. The preparations of *Fucus vesiculosus*, which form the active ingredients in some quack remedies for obesity, appear to depend for their value on the iodine contained in them. As a general rule drugs are not required for the treatment of obesity, but attention must be directed chiefly to diet. Several systems of dietary for corpulent persons have been drawn up by physicians, the best known being that recommended by Mr. Banting in his "Letter on Corpulence," published in 1863. The essential feature in all these systems is the avoidance as far as possible of fatty and starchy foods, such articles being taken only in the smallest quantities possible where they cannot be given up altogether. Lean meats, sweetbreads, fish, except rich kinds—such as eel, salmon, turbot—clear soups, poultry, game, eggs, cheese, green vegetables of all descriptions, if prepared without fat, toast, rusks, gluten bread, fresh fruit, and pickles are allowable articles of diet. Bread, biscuits, milk, potatoes, carrots, turnips, parsnips, beet-root, rice, sugar, fat (hot or cold), butter, sweets, dried fruits, &c., should either be avoided, or, as in the case of bread, milk, sugar, which it would be difficult to give up altogether, partaken of only in small quantities. Alcoholic beverages should generally be avoided, beer and spirits being absolutely forbidden, except in cases of emergency. Cider or the light dry wines, both white and red, diluted with water, are less objectionable.

With obesity, as with many other things, prevention is better than cure, and when an undue increase of weight is observed, it is as well to try increased exercise, restraint of appetite, and the giving up of beer and spirits before resorting to the more active measures indicated. In all cases where an extensive change of diet is contemplated it is well to secure skilled advice at the outset, and to pursue the treatment under proper medical supervision.

OBI or **OB** is the most western of the three great rivers of Siberia, rises in the Altai Mountains, about 50° N. lat., and 89° E. lon., and has a general north-west and west course, past Barnaul and Kholivan, to its junction with the Irtysh at Samurova, from which place it flows north in a double channel, past Berezov and Obdorsk to the Gulf of Obi, an estuary 400 miles long and 100 broad, by which it enters the Arctic Ocean, after a course of 2700 miles. Area of basin, including the whole country between the Ural, Turkestan, and the Yenisei, about 1,295,000 square miles. Tributaries—the Tom, Ket, Vakh, and Irtysh, which last river receives the Oni, Ishim, Tobol, Tavda, &c., and being larger and longer than the Obi, ought properly to give its name to the latter. The Obi is the richest in fish of any river of the Russian Empire. It is frozen over from the second half of October till April. It rises and overflows in May. The main river and several of its tributaries are now regularly navigated by transport steamers; and a sea route from this river through the Kara Sea to Norway was found in 1876 between Siberia and Western Europe,

but the difficulties of its navigation render it almost useless for commerce.

OBITUARY, in the Roman Catholic Church, the book in which are registered the names of deceased persons for whom obits are to be performed, and the days of their funerals. The term is used generally for a record of deaths.

OBJECT LESSON, an excellent preparatory method towards science-teaching. In its simplest form it is a mere exercise of the pupils' observing powers in noting the properties of a thing. A large amount of valuable knowledge of familiar things can be thus given; but the main feature is the "first-hand" nature of the knowledge gained, very valuable as against far more elaborate information gained through mere description. Rousseau in his famous "Emile" was the first to point out the necessity of this principle; Pestalozzi was the first to organize it into the form of "object lessons."

OB'LATE, in ecclesiastical antiquities, has various meanings; thus it refers to (1) a class of religious bodies in the Roman Catholic Church which differ from the monastic orders in not being bound by any solemn vows. These were instituted by St. Charles Borromeo towards the close of the sixteenth century. (2) An oblate is a person who, on entering the monastic state, makes over all his property for the benefit of the community. (3) A layman residing as an inmate in a community to which he has assigned his property, either in perpetuity or for such time as he may continue a resident. (4) One dedicated to a religious order by his parents from his early life. (5) A layman who makes over his property, and dedicates his person as bondsman, to a monastic community.

OB'LATE, in physics, is a term applied to a spheroid which is made by the revolution of an ellipse about the smaller of the two axes, in opposition to "prolate," where the larger axis of the ellipse serves as the median line. The earth, since it bulges at the equator, is an oblate spheroid.

OBLATION (Lat. *oblatus*, brought to or before), an offering, or anything given as an act of reverence to the use of the church. The custom of oblations commenced in the early ages of Christianity, the ministers of religion for the first two or three centuries depending entirely on the free gifts or oblations of the people for their maintenance. But the custom became in subsequent periods exposed to many abuses and extortions, which were continued even after a legal or state provision had been made for the priesthood. During the middle ages there was a great variety of these oblations, as mentioned by our historians, which were considered very oppressive. Thus there were the *Oblationes Altaris*, the fees of the priest for saying mass; *Oblationes Mortuorum* or *Funerales*, given at funerals; *Oblationes Defunctorum*, which were given to the church by the last will and testament of persons dying; *Oblationes Penitentium*, offerings made by persons who were penitent; *Oblationes Pentecostales*, &c. The chief or principal feasts for the oblations of the altar were All Saints, Christmas, Candlemas, and Easter, which were called *Oblationes quatuor principales*; and of the customary offerings from the parishioners to the parish priest, solemnly laid on the altar, the mass or sacrament offerings were usually threepence at Christmas, twopence at Easter, and a penny at the two other principal feasts. Under this title of Oblations were comprehended all the accustomed dues for sacramentalia or Christian offices; and also the little sums paid for saying masses and prayers for the deceased. *Oblationes Funerales* were often the best horse of the defunct, delivered at the church gate or grave to the priest of the parish, to which old custom we owe the origin of mortuaries, &c.

OBLIGATION (from the Latin *obligatio*, a word which simply signifies a "binding"). The term is sometimes used in our English system; and, properly understood, it comprehends all debts or duties which a man

can owe to a certain person or certain persons. It is a larger term than *contract*, which is merely one of the events out of which obligations arise, for there are obligations which are not founded on contract.

An obligation may arise from contract (and most obligations do arise from contract), when an agreement, either express or implied, is necessary; but on the other hand it is not every agreement which produces a contract.

OBOE, the Italianized form of *Hautbois* ("high-pitched wood-pipe"), which is the French term, is now the most usual designation in England for the well-known orchestral instrument anciently called *Waite* or *Wayght* by our own forefathers. The original name is yet preserved in the name of the wind-bands (*Waits*) who about Christmas time make night melodious, or the reverse, with serenades. The oboe is of vast antiquity and of widespread nationality. It is found everywhere, and in all ages. It can be certainly ascribed by means of pictures and sculptures to extremely early dates in the Egyptian and Assyrian kingdoms. It is a straight conical pipe, nearly 2 feet in length, and was possibly once played with a single beating reed like a clarinet now is, but for a very long time the present double reed has been in use. As we now have it a short metal tube is inserted in the end of the wooden pipe, and to the sides of this *staple* are bound the two reeds, the flutter of which as the performer blows between them, pinching them at the same time with his lips, causes the vibration in the pipe which is sufficient to make a musical tone. [See *ACOUSTICS*.] But so little wind is necessary or even desirable to play the oboe, that the performer is constantly *holding his breath*, and frequent pauses are necessary in writing for the instrument to give the oboist time to breathe and to release the fatiguing pressure of the lips.

The pipe of the oboe is in three parts or joints exclusive of the "staple." It possesses a complete chromatic scale, and its compass is from middle C upwards for nearly two and a half octaves. As there are many notes which are difficult to produce on the instrument, these troubles have called forth much ingenuity in the form of various systems of keys (as with the flute, &c.), which have become more and more elaborate until a Boehm concert oboe of the present day presents the appearance of a tube of wood suspended in the midst of an intricate network of metal rods. It is the most elaborately keyed of all the instruments.

The thin piercing exquisitely sensitive tone of the oboe is well known. It sets the pitch for the orchestra because of its penetrating note. It is nearer to the bassoon (also a double reed instrument) than to the flute or clarinet, but is used habitually with all three as the "wood wind" so familiar in orchestral pieces. The oboe plays usually immediately below or immediately above the flute, and has almost always the second line in an orchestral score next under the flute and above the clarinet. There are always two oboes (at least) in a full orchestra, so as to be able to give harmonized oboe passages by themselves.

The *oboe d'amore* (in A) is a minor third below the ordinary oboe, and the *oboe musette* (E♭) a minor third above it. Both are rarely used. The *oboe di caccia* (hunting horn of wood) is an obsolete instrument a fifth below our oboe. Presumably a hunting horn originally, it grew, like the brass horn (French horn), into a fine orchestral instrument. Bach is never weary of writing for it. Though its pitch is the same as that of a *cornu inglese* (English horn) or tenor oboe, the tone of the *oboe di caccia* is better described as that of a tenor bassoon. It seems a great pity that so fine an instrument is not revived.

OBOLOS was a Greek coin, both silver and brass. At Athens it was of silver, the sixth part of a drachma, and worth somewhat more than three halfpence of our money. In the Ægætan standard the value was about half as much more. The value of the obolos declined, until it

became about the value of our halfpenny; and it was used down to quite recent times to signify the bronze or copper coin of about that value which circulated in the Ionian Islands and part of Greece as the hundredth part of the Ionian dollar. *Ob.* was a fourth contraction in use among our forefathers, following *£ s. d.*, and taking in the halfpence. Thus in Part I. of Shakspeare's "*Henry IV.*" (act 2., last scene), the prince finds Falstaff's tavern bill; and reads therein, after gullions of sack (wine), "Item, bread, *oh.*," and cries, "Oh monstrous! but one halfpenny worth of bread to this intolerable deal of sack."

O'BRECHT (or **HOBRECHT**), **JAKOB**, one of the great masters of music in the middle ages, was born at Utrecht in 1430, ten years after Ockeghem, and ten years before Josquin; and died about 1500. For the last ten years of his life he held the highly honourable post of organist of Antwerp, then the leading musical city. He had previously travelled much, staying at one time with Lorenzo de' Medici at Florence. His musæ were thought to be among the best of his day, and Erasmus held it an honour to have been taught music by him.

O'BRIEN, WILLIAM SMITH, born 17th October, 1803, was the son of Sir Edward O'Brien, Bart., of Dromoland, in the county of Clare, Ireland, and brother of Lord Inchiquin, one of the representative peers for Ireland. O'Brien was educated at Harrow and Trinity College, Cambridge. He was returned to Parliament for the borough of Ennis in 1826, and in 1835 for the county of Limerick. He was a great advocate for Catholic emancipation, and warmly espoused all the Irish grievances. He refused to serve on parliamentary committees, and was imprisoned by order of the Speaker. In 1811 he left Parliament and joined O'Connell in agitating for a repeal of the union. In 1818 O'Brien took part in an attempt at rebellion in the south of Ireland, and was arrested, tried, and condemned to death. This sentence was commuted into transportation for life; but in 1856 he was again permitted to return to his native country. From that time he abstained from taking any active part in political affairs. He died at Bangor, North Wales, 18th June, 1864.

OBSERVANTS (friars), a branch of the Franciscans. Some relaxation having been effected in the rule of the Franciscan order, it was thought requisite to restore it to its first rule and original institution; whereupon such as continued under the relaxed order were called *Conventuals*, and such as accepted the reformation were called *Observants* or *Recollets*. This reformation was begun about 1100 by St. Bernard, or Bernardin of Siena; it was confirmed by the Council of Constance in 1414, and afterwards by Eugenius IV. and other popes.

OBSERVATORY, a building erected and equipped with suitable apparatus for the careful and regular observation of natural phenomena. Up to a comparatively recent date, the sole work of an observatory consisted in observing and recording the position of the heavenly bodies; but with the progress of terrestrial magnetism and meteorology, the necessity for systematic observations became apparent, and this work was also undertaken by many of the astronomical observatories. At the present day, owing to the development of astronomical science, the tendency is towards the separate establishment of meteorological and magnetical observatories, though some institutions still conduct observations in each of these departments of study.

Of the institutions established in ancient times for the observation of the heavenly bodies we possess only an imperfect knowledge. The observatory of Alexandria is alone famous in the history of Greek astronomy, and this, after an activity lasting for about 400 years, came to an end about the middle or end of the second century of the Christian era. An account of the valuable discoveries and observations made at this observatory by Hipparchus (B.C. 160-125) and Ptolemy (A.D. 130-150) is given

under ASTRONOMY. When the study of astronomy began to be cultivated by the Saracens, observatories were established at Bagdad, and possibly at Damascus, early in the ninth century, followed by the erection of one on the Mokattam, near Cairo, about 1000, and at a later period by the important observatories which were established by the Mongol khans in Persia. The first observatory to be erected in Europe was that of Bernhard Walther, at Nuremberg, in 1472, and the valuable work done at this observatory during the thirty years following this date served to fully establish the study of practical astronomy, though it was not until nearly two centuries afterwards that observatories began to be established by governments and public bodies. The observatory of the University of Leyden was founded as early at least as 1632, and that of Copenhagen University dates from 1641, the national observatory of Paris being founded in 1667, and that of Greenwich in 1675.

At the present day, public observatories are established in all civilized countries, most of which are devoted to certain special fields of work, the results of their labours being published periodically for the benefit of the scientific world. In Great Britain the largest and most important observatory is the Royal Observatory at Greenwich, which has already been described under GREENWICH OBSERVATORY. The other public observatories of the British Isles are those of Oxford, Cambridge, Liverpool, Durham, Kew, Edinburgh, Glasgow, Dublin, and Armagh. The Radcliffe Observatory at Oxford was erected about the year 1774. It possesses a fine heliometer, the object-glass of which is of $7\frac{1}{2}$ inches aperture and $10\frac{1}{2}$ feet focal length, a meridian circle by Troughton and Sims, mounted in 1861, and a valuable set of self recording meteorological instruments. The Oxford University Observatory, under the Savilian professor of astronomy, is celebrated for its $12\frac{1}{4}$ -inch equatorial refractor, used for micrometer work and photometric observations, and its 13-inch reflector, made and given by Mr. De la Rue, used for lunar photographs. The Cambridge Observatory was built in 1824, and contains many fine instruments, especially the Northumberland equatorial telescope, which is 20 feet focal length, and has an object-glass with a clear aperture of $11\frac{1}{2}$ inches. It is extensively used in observations of the planets and planetoids. The observatory at Liverpool was established in 1844, for the purpose of obtaining and preserving correct Greenwich time, and for rating and testing chronometers. In these special objects it has taken the lead of all similar institutions. It also possesses good astronomical and meteorological instruments. The Durham Observatory was founded in 1841, and is under the direction of the professor of mathematics and astronomy at the university. It has an equatorial refractor of $6\frac{1}{2}$ inches aperture, with which some useful observations of the minor planets, comets, and double stars have been made. The Kew Observatory is chiefly devoted to meteorological and magnetic observations. The Royal Observatory of Edinburgh is on the Calton Hill, and it has contributed to astronomical science some extensive meridian observations of fixed stars. By means of its electric clock time-guns are fired at Edinburgh Castle and at Newcastle daily at one o'clock. This observatory is at present inadequately equipped with modern instruments. The Glasgow Observatory, situated north of the city, near Gartnavel, is well supplied with astronomical instruments, and it published in 1883 a valuable catalogue of 6415 stars from meridian observations made since 1860. The observatory of the Dublin University is situated at Dunsink, about 4 miles north-west of Dublin, and is under the direction of Dr. R. S. Ball, the astronomer-royal for Ireland. Since 1868 it has possessed an equatorial refractor, having an object-glass of $11\frac{1}{2}$ inches aperture. A meridian circle of 6'1 inches aperture was mounted in 1873, and a large chronograph in 1882. The equatorial has been used by Brünnow

and his successor, Dr. R. S. Ball, for researches on stellar parallax, and at this observatory regular observations are made of the coloured stars, stars with proper motion, &c., the results being published in 40 volumes. Armagh Observatory, founded and endowed in 1791, and enlarged in 1827, possesses a 7-inch telescope and a 15-inch reflector. A catalogue of 5315 stars, observed from 1823, was published in 1859. Armagh has also done good work as a meteorological observatory. In addition to the public observatories mentioned, there are also many well-equipped private observatories in the United Kingdom, but space will not allow of particular mention of these.

Of foreign observatories, the one of most note is the Royal Observatory of Paris, founded in 1671. Originally it was under the directorship of the celebrated Dominique Cassini, and it has since been under the direction of some of the most eminent of the astronomers of modern times. It possesses some large and valuable instruments, among which is a new 29-inch refractor. Nearly every European country now possesses its public observatories, and they are also established in India, Hong Kong, South Africa, and Australia. In the United States there are numerous observatories, both public and private, well provided with the best modern instruments.

OBSIDIAN is a glassy-looking volcanic rock, usually of a dark green or black colour, and often appropriately termed "volcanic glass;" it is, indeed, scarcely distinguishable in appearance from ordinary bottle-glass or glass-slag, and has a similar shell-like (conchoidal) fracture. In chemical composition it agrees closely with many highly silicated crystalline and semi-crystalline rocks—being a silicate of alumina with varying small amounts of potash, soda, lime, magnesia, iron, &c.—and owes its characteristic amorphous structure merely to rapid cooling. To the student of rocks, obsidian is of especial interest on account of the incipient crystallizations produced by percolating moisture. When within the reach of savage tribes, it is frequently employed as a suitable material for sharp-edged implements. See **STONE IMPLEMENTS**.

OBSIDIONAL CROWN (Lat. *obsidium*, a siege), a wreath or crown with which the Roman generals were honoured who had delivered the army from the dangers of a siege, or when they were surrounded by an enemy. It was simply made of grass or herbs found upon the spot where the action had been performed, and placed on the brows of the relieving general by the soldiers themselves.

OC, LENGUA D' and LANGUE D'OIL. See **LANGUE D'OIL**.

OCARINA, a very simple musical instrument, originating in Tyrol, made out of a hollow lump of baked clay, with a large hole for a whistle-shaped mouthpiece, and smaller holes as ventages. The ease with which it can be learnt, and its trifling cost, have given it a certain popularity; the tone is somewhat flute-like, but hollow and coarse, and the scale is extremely limited. A Tyrolean band of ocarina players, with instruments of all sizes, had some success about the year 1880: the chromatic scale was obtained by them by very skilful "dovetailing" between two or three performers.

OCCAM, WILLIAM OF, one of the greatest of the schoolmen of the middle ages, surnamed by his followers and admirers "the Invincible Doctor," was born in the reign of Henry III., about 1270, of humble parents in the village of Occam, in Surrey. The exact date of his birth is unknown, and very little has been preserved concerning the early life of this great English thinker. Tradition asserts that he studied at Merton College, Oxford, and that he held several benefices in his native country, resigning them in order to enter the Franciscan order. After becoming a Franciscan he proceeded to Paris, and there studied under Scotus, thus mastering the doctrines of which he afterwards became the most conspicuous antagonist.

At Paris his strength of intellect and will were soon felt, and when from being a listener he became a lecturer, the boldness of his views attracted much attention. The opening years of the fourteenth century were disturbed in France by the quarrel between Pope Boniface VIII. and King Philip IV. Philip had subjected the clergy to taxation, and had forbidden the Pope to levy contributions in his dominions, and the latter, by way of retaliation, had excommunicated the king. Occam interposed with characteristic energy in the quarrel, and warmly espoused the side of the civil power. The celebrated work published at this time entitled "*Disputatio inter Clericum et Militem*," which denies that the popes have any temporal authority, is usually ascribed to Occam; and it certainly represents his opinions, though some modern scholars have questioned his authorship. After the death of Boniface, Occam for several years devoted his attention chiefly to philosophy, and he became the leader of the theological and philosophical rationalism of his age. The system which he advocated, and which is generally known as Nominalism, was not new, for more than two centuries before a similar doctrine had been taught at Paris by Roscellinus, and recommended to his crowded audience by the eloquence of Abelard; while the problems involved in the controversy between Nominalism and Realism are in reality as old as Plato and Aristotle. The doctrine, however, had failed to secure general acceptance, and in the din of the Thomist and Scotist controversy, in which both parties were partisans of Realism, it had been forgotten. It was now, however, revived by Occam, and while his statement of the doctrine contrasted very favourably with that of his predecessors in its precision and clearness, he defended it with such rigorous logic, and so fearlessly followed it into its consequences, as to gain for himself his title of "Invincible." From Paris the controversy passed to all the universities of Europe, and it was soon seen that it was vitally connected with the favourite and traditional thought of the age. From the universities the dispute passed into the church, and into the world of courts and camps, the Emperor Louis of Bavaria becoming a patron of Nominalism, and the French king a supporter of the Realists and a persecutor of their opponents. In order to understand the fierceness of the struggle, it must be remembered that the reality of universals, or their independence of the conscious act, was the recognized assumption of the philosophy of that age; and Occam, by his direct challenge, assumed the appearance of a stern iconoclast and an assailant of the very foundations of faith and knowledge. About 1320 or 1321, Occam again plunged into ecclesiastical controversy, and became involved in a fierce dispute with Pope John XXII. A certain Narbonne priest had been assailed by the inquisitors for advocating the restoration of apostolic poverty and communism in the church, and had been defended by Béranger Salou, a Franciscan of Perpignan. Salou was charged with heresy by Pope John XXII; but he was defended by his order, and among others by Michael of Cesena, the general superior, Bonagratia of Bergamo, and William of Occam. The vehemence of their attack upon the papacy soon marked them out for persecution, and they were summoned before the papal court at Avignon, and put upon their trial for heresy. For a period of four months they were imprisoned in the dungeons of the papal palace, but afterwards managed to escape by the aid of Louis of Bavaria, and taking refuge at Munich, they formed the most conspicuous members of that band of Franciscans who aided this monarch in his contest with the papal curia. At Munich Occam received unmovable the papal condemnation and excommunication, and, protected by the king, he continued the contest by means of his powerful writings, and when Michael of Cesena died in 1342, Occam received from him the official seal of the order, and was recognized as general by his party. He

died at Munich about 1349, but the exact date of his death and the place of his burial are unknown. According to some historians he was reconciled to the papacy before his death; but others assert that, like his companions, he died under the ban of excommunication. The principal writings of Occam are his "*Expositio Aurea*," containing a series of commentaries upon the "*Isagoge*" of Porphyry and the "*Categories*" of Aristotle; the "*Centilogium Theologicum*;" a "*Commentary on the Sentences*" of Peter Lombard, which was long almost as renowned as the work which gave it birth; his "*Tractatus de Sacramento Altaris*," in which, while he accepts transubstantiation, he suggests the theory which was afterwards adopted by Luther, and is now known as consubstantiation; a series of important treatises called forth by the controversy with the papacy, among which may be mentioned the "*Opus Nonaginta Dierum*" (1330-33); the "*Tractatus de Dogmatibus Johannis XXII. Papæ*" (1333-34); the "*Compendium Errorum Johannis XXII. Papæ*" (1335-38); the "*Defensorium Contra Errores Johannis XXII. Papæ*" (1335-39); and his "*Super Potestate Summi Pontificis Octo Questionum Decisiones*" (1339-42). His logical doctrine is presented in his "*Tractatus Logice*," published at Paris in 1488.

In the destruction of the fictions and illusions of scholasticism, in the introduction of the theological scepticism of the later mediæval period, and in the important contest between the civil power and the papacy, Occam took a prominent part; in his unfinished philosophy we find many anticipations of later doctrines—some promulgated by his countrymen, Hobbes and Locke, and others matters of discussion in our own generation; while, when we look back, we see that the strong mind, iron logic, and unconquerable will of the Invincible Doctor render him, in the history of opinion, one of the most conspicuous figures of the century in which he lived.

For an account of his logic see Prantl, "*Geschichte der Logik*" (1855-70); for his political works see Riezler, "*Die Literarischen Widersacher der Päpste zur Zeit Ludwig des Baiers*" (1874); and for his philosophy see Stöckl's "*Geschichte der Philosophie des Mittelalters*" (1861-66).

OCCLEVE (or **HOCLEVE**), **THOMAS**, the contemporary of Lydgate, and with him the chief Englishman of letters in the generation succeeding that of Chaucer, was about thirty when Chaucer died. Occleve was born in the Strand, London, about 1370, and died probably about 1430. Like Chaucer, he held a small government appointment. His chief works are the book of counsel to young men, "*La Male Règle de T. Hocceleve*," and a translation of "*De Regimine Principum*," a mediæval compilation absurdly believed to represent Aristotle's teaching as given to the youthful Alexander. This Occleve Englished as "*The Governail of Princes*," and in a most interesting preface, for which indeed the book is chiefly valuable, tells how his patron Henry V., when Prince of Wales, sought to free a Lollard from burning at the stake, and had the fire stopped for that purpose, but how the heretic chose rather to be burnt than to enjoy the prince's clemency and conform. The rotten state of the church is powerfully shown, Occleve fully confirming the works of Wyclif on that score; and the preface concludes with an earnest appeal to the kings of France and of England to cease the "Hundred Years' War," and war only on the enemies of Christ.

OCCULTATION (Lat. *occulto*, I hide). This word, which in astronomy designates any eclipse of one heavenly body by another, is particularly applied to the eclipse of a fixed star by the moon.

When the moon approaches the star, instead of an instant of contact, followed by disappearance of the star, the latter for a few seconds is frequently thrown upon the moon, as if it were the nearer body and were going to cross the moon's surface, as Venus does that of the sun

during a transit. While this is taking place, which sometimes lasts until the star has fairly left the moon's limb or border, the star preserves its light, though it frequently undergoes a change of colour. Aldebaran, whose natural colour is inclining to red, has been seen to present this phenomenon much more frequently than any other star, though many others have done it. It is to be noted that this phenomenon has been seen, though rarely, at the dark edge of the moon as well as at the enlightened. Its cause is matter of much diversity of opinion.

OCEAN (Gr. *Okeanos*) is a term used in an absolute sense to express collectively the immense mass of salt water that covers about three-fourths of the entire surface of the earth. The word first occurs in Homer, who uses it to designate the river or stream which, according to his idea, surrounded the surface of the earth like a circle. The Greek geographers, however, knew that the ocean was a wide expanse of water which surrounded the land, and the term ocean was used by them in this sense. (Strabo, p. 124; Pomponius Mela, l. 1.) The term is also applied to large portions of this great mass of water which are separated from each other by tolerably well-marked boundaries. The widest expanse of salt water is the **PACIFIC OCEAN**, which covers upwards of 70,000,000 English square miles, or more than all the dry land on the surface of the globe. The ocean which extends between Europe and Africa on the east and America on the west, is called the **ATLANTIC**, and is estimated to occupy nearly 30,000,000 square miles, including in this area the numerous seas that belong to it. That portion of the ocean which lies between the Pacific and the Atlantic is called the Indian Ocean. Its surface, including the Red Sea, Persian Gulf, Bay of Bengal, &c., is supposed to include more than 25,000,000 square miles. The northern coasts of Europe, Asia, and America are supposed not to extend to the Arctic Pole, but terminate between 70° and 80° N. lat. Between these coasts is a sea, which may be about 2000 miles across from one continent to the other. This sea is called the Arctic; it is connected with the Pacific by Behring's Strait, and with the Atlantic by the wide strait between Greenland and Norway. Its area is estimated at 4,000,000 square miles.

The chief characteristic of ocean water is its saltness. This quality is not uniform, but varies according to the quantity of fresh water received from land areas or the rapidity of evaporation from the surface. The mean amount of saline matters held in solution is about 3.5 per cent. The ingredients consist of chloride of sodium, or common salt, by far the most abundant, chloride of magnesium, and sulphate of magnesium, or Epsom salt, to the presence of which the unpleasant bitter taste of sea-water is owing, with potassium and lime salts. Other substances mingle with these in small but still determinable quantities, as silica, phosphoric acid, carbonic acid, and oxide of iron. This constitution of the fluid renders it more buoyant, and consequently better adapted for navigation, while a larger area is preserved from being ice-bound. Fresh water freezes at the temperature of 32°, but a temperature of 25° or 27° is required for the congelation of salt water. The deep sea is the "blue water" of the mariner, so called from its pure ultramarine tint when seen apart from foreign influences, which becomes less decided as the depth decreases. Though water is naturally colourless when viewed in small bulk, it is blue like the atmosphere when seen in mass, owing to the blue rays of the spectrum being less liable to be absorbed by a transparent fluid than the other prismatic colours. The reflection of clouds, and the presence of foreign substances, however, greatly affect the colour. Thus, in the neighbourhood of the Azores and Canary Islands, the sea is green, white in portions of the Gulf of Guinea, black around the Maldivé Archipelago, yellowish between China and Japan, while purple, red, and rose tints are observed in the Levant, the Red Sea, the Vermilion

Sea, off California, and at the mouth of the Plata. These appearances are the effect of various causes, as the existence of marine vegetation at or near the surface, the infusion of earthy substances brought down by the rivers, and the presence in enormous swarms of the minute forms of animal life. In like manner, phosphorescence, a spectacle of strange magnificence, is mainly caused by the presence of minute Invertebrata in countless millions, which are phosphorescent while alive—a property retained by the gelatinous particles of their decomposing remains, with which certain parts of the deep are thickly charged. Motion is unceasing in the ocean, and a system of circulation is constantly maintained, as well in the horizontal as in the vertical direction. Three principal movements are exhibited, known as *wind waves*, *tidal waves*, and *currents*, which are either the effect of atmospheric or astronomical causes, and operate with mighty though changeable energy upon the yielding fluid.

The lower stratum of the atmosphere, being in immediate contact with the surface of the sea, disturbs by its agitations the equilibrium of the aqueous particles, and produces waves proportioned in their height and volume to the intensity and duration of the exciting cause. A gentle breeze blowing in the direction parallel to the surface raises ripples, which become more prominent as the action is continued. A brisk gale, pressing obliquely upon the water, forces its particles much more strongly above the general level, and gives rise to undulations which rock to and fro the largest vessels upon their bosom. The storm or hurricane occasions the mightiest oscillations, which assume the form of long rolling billows when their development is unimpeded, as in the open ocean, and the winds blow in the same direction for any considerable length of time. The progressive motion of the undulations produced appears like an onward flow of water, but a bird resting on the sea, or a boat adrift upon the surface, is not carried forward by the waves. There is merely a rise and fall with them, except in the case of a strong continuous wind, which occasions a slight superficial current. But when the oscillatory waves approach a shore, or come into shallow water, they form waves of translation, which "break," as it is called, become crested with foam, and dash with great violence upon the strand.

Long after the storm-winds have subsided, and the surface has become smooth, it is observed to heave with mighty undulations, upon the principle of the pendulum, swinging for some time after it has received an impulse. This undulatory movement, called the "swell," is propagated far beyond the area visited by the gale, but becomes more feeble with the distance from the focus of disturbance. Hence it is not uncommon to mark the ocean rolling and breaking with great violence on the shores in a perfectly calm state of the atmosphere. But though imperceptible to the eye, a movement far more powerful in its effects is continually taking place throughout the mass of the ocean. Changing temperature, and its accompanying change in bulk, is everlastingly producing a circulation among the atoms which make up the ocean. To the effect of this circulation the late Dr. Carpenter attributed the regular flow of a deep current of colder water from the poles to the equator, and of a warm surface current from the equator to the poles, of the existence of which there is good evidence. He considered he had clearly proved that as the Polar water is cooled it contracts and grows denser; thus its level would be lowered if the warmer water from the equatorial area did not flow towards the Polar regions. When this dense Polar water has on the top of it the additional water which has flowed in to maintain the level, a portion of the lower part must flow away. Thus there will be a tendency to a renewed lowering of the level, which must draw in water from the equatorial region, and there will always be, as that water flows in and is cooled down, a tendency

to the maintenance of a greater weight or downward pressure of water in the Polar area; so that by these two influences—the lowering of the level and the increase of the density of the water—this constant disturbance of level and disturbance of equilibrium is ever going on, producing an inflow from the equatorial towards the Polar regions on the surface, and an outflow from the Polar regions towards the equatorial area at the bottom. This conclusion has, however, been disputed by some able scientists. However this may be, the temperature of oceanic water varies considerably, being warmest at the surface and becoming colder as the depth increases, although not at a uniform rate. On the western side of the South Atlantic the bottom water is colder than on the eastern, showing that the antarctic cold current runs to the north-westward.

The temperature of the water at the equator generally decreases far more rapidly as the depth increases than in other regions. For instance, although the equatorial surface water is warmer than at Madeira, at 60 fathoms the thermometer marked 61.5° Fahr., which is the same temperature at that depth as at Madeira; at 150 fathoms it was 57° Fahr. only, which is the same as in the Bay of Biscay. We may, from these and numerous similar observations, conclude that the solar heat does not immediately affect the temperature of water at a greater depth than 60 or 70 fathoms. Below this cold and darkness prevail, growing more intense as the depth increases; but, contrary to the ideas which formerly prevailed, animal life in abundance has been found at the greatest depths.

It is generally observed that along a low, level, and sandy shore the sea is found shallow; while in the neighbourhood of a bold and mountainous coast the reverse takes place. Thus the recession of the tide from the flats of Holland or of Lincolnshire converts large tracts into dry land; while in the Mediterranean, where Mount Athos rises abruptly to the height of 6000 feet, there occurs a depth of 500 or 600 feet close to the shore. Around St. Helena, which projects to a great and sudden elevation, the depth is very great; while the greatest Atlantic depths were ascertained by the *Challenger* to be about 80 miles from the Bermudas, where a depth of 3875 fathoms, or 23,250 feet, was sounded. The greatest Pacific depth was found near Japan by the Americans, where the soundings gave a depth of about 5 miles or 27,000 feet. See also the article CURRENT.

OCEAN CURRENTS. See CURRENT.

OCEANIA, a name sometimes given to a fifth division of the globe, embracing North-west Oceania or the Eastern Archipelago, including the islands on the south-east of Asia, of which the principal groups are the Sunda Isles, the Moluccas, the Philippines, &c.; South-west Oceania or Australasia, including Australia, New Zealand, &c.; and Eastern Oceania or Polynesia, which includes the numerous groups in the western part of the South Pacific.

OCEANUS. See OKEANOS.

OCELOT (*Felis pardalis*) is one of the smaller species of the family FELIDÆ, to which the lion, tiger, leopard, and other cats belong. The ocelot is a native of America, extending from Texas to Paraguay. It is usually a little over 3 feet in length, exclusive of the tail, which measures some 10 or 12 inches. It is one of the most beautifully marked of all the cats. The general ground colour is tawny or reddish-gray, marked by spots and blotches of various sizes, each consisting of a black ring inclosing an area somewhat darker than the ground tint. The tail is ringed with black. The ocelot is extremely bloodthirsty and savage, destroying vast quantities of animals for the sake of their blood. It destroys birds and mammals, but rarely attacks men. It is an expert climber. The species known as the Long-tailed Ocelot (*Felis macrura*) has been shown to be but a variety of the MARGAY (*Felis tigrina*).

O'CHIL HILLS, a range of mountains in the counties of Perth, Kircross, and Clackmannan, forming a part of the

chain which crosses Scotland north of the friths of Tay and Clyde, under the name of Sidlaw, Ochil, and Lennox hills, forming the northern boundary of the coal-fields of Scotland. They begin on the south-west side of the Frith of Tay, near Abernethy, and extend in a south-westerly direction to the Bridge of Allan, 2 miles north of Stirling; length, 25 miles. Like the other ranges, they are composed of various trap rocks, claystones, and porphyries, and present a remarkably steep face to the plain on the south, suddenly cutting off the coal measures, which are tilted up at a high angle and greatly altered. The highest summit is Ben Cleuch, north of Alva, 2363 feet high. Silver, copper, cobalt, lead, and iron have been found in some places toward the western termination.

OCHINO, BERNARDINO, an eminent Italian reformer, was born at Siena in 1487. After receiving an imperfect education he joined the order of St. Francis, and in 1531 he attached himself to the Capuchins, of which order he was chosen general in 1538, and again in 1541. Before this he had become famous for his zeal and eloquence, and it is said that on one occasion when he preached before Charles V., the latter remarked, "This man could move the very stones." In 1539 his sermons on the subject of justification brought him under the suspicion of the papal authorities, and in 1542 he was cited to appear before the Inquisition in Rome. Instead of complying he fled to Geneva, where he was welcomed by Calvin, and where he publicly accepted the principles of the Reformation. Here he published six small volumes of sermons, "Prediche" (1542-44), and in 1515 he became pastor of an Italian congregation at Augsburg. Compelled to flee in 1517, he repaired to England, where Crammer made him a prebendary of Canterbury, and obtained for him a pension from the privy purse of Edward VI. In England he composed his "Tragedy," an imaginative theological drama, the conception of which bears a remarkable resemblance to the "Paradise Lost" of Milton. On the accession of Mary in 1553, Ochino settled at Zurich as pastor of the exiles of Locarno, but unlike most of his compatriots he failed to come to a halt at Protestantism, and continuing his studies soon found himself at variance with the strict orthodoxy around him. At last some of his speculations, published in a work entitled the "Thirty Dialogues" (1563), brought upon him the anger of Beza and Bullinger, and the book was condemned by the magistrates of Zurich, its author being banished from the city. Rejected also from Basel and Mülhausen, he sought refuge in Nürnberg, then in Cracow, but found rest nowhere, and after losing three of his four children by the plague he died in obscurity at Schlakau in Moravia, about the end of 1564. He is remarkable from the fact that in his individual history he passed through all the phases of theological thought between Roman Catholicism, Protestantism, and Socinianism. A list of his writings is given by J. Voigt, in his "Catalogue Librorum Rariorum" (Hamburg, 1732). For a compendium of all the information attainable about him, see Dr. Karl Benrath's "Bernardino Ochino of Siena" (English translation by Miss Helen Zimmern, London, 1877).

OCHNACEÆ is an order of plants belonging to the POLYPETALÆ, cohort Geraniales. The species are shrubs or trees, with alternate, simple, thick, shining, stipulate leaves. They are natives of the tropics, and chiefly of America. The bark of a species of Ochna is used in Brazil as a cure for sores produced in cattle by insects. The root and leaves of *Gomphia angustifolia* is used in Malabar as a tonic. There are four or five free sepals, generally scarious; the petals are of the same number, and are also free. The torus becomes enlarged after flowering. The stamens are few or many, with free filaments; the anthers are much elongated, basifix, dehiscing either by pores or longitudinally. The ovary is generally lobed, while the

number of cells and the placentation is various. There are one or two or several ovules in the cells, ascending or sometimes pendulous, with ventral raphe. The style is subulate, with a terminal acute stigma. The embryo is large.

OCH'RA, OKRA, or OCHRO, a plant whose fruit is used as a vegetable in the West Indies, the United States, and in South America. It is an annual, and has the general aspect of the mallow family (*MALVACEÆ*), to which it belongs. The stem is 2 to 6 feet high, with cordate, five-lobed leaves. The flowers, situated in the axils of the leaves, are yellow, with a purplish centre. The fruit is a narrow, ten-angled pod, 4 to 8 inches long. The pods are full of mucilage, and are chiefly used to thicken soup. They are gathered before they are ripe, and preserved like capers. The botanical name of the plant is *Hibiscus esculentus*.

OCHRE (from the Gr. *ochras*, sallow in colour) is the general term applied to earthy or argillaceous matters used as pigments in the arts. As a rule they are red earthy deposits, consisting either of clayey or limy matter, or both, and are deeply stained by an abundant intermixture of hydrated peroxide of iron. They are found in workable quantities, and of fine quality, in the Upper Jurassic strata near Oxford, and plentiful supplies are also obtainable from the Isle of Wight, and several localities in France and Germany. In districts where such highly ferruginous rocks as most of those of carboniferous age are developed, considerable accumulations of ochre also take place in the streams and water-courses; and the yellow variety, which owes its light shade to the presence of a large amount of combined water, is obviously that most commonly met with in nature. *Red ochre* (or "red raddle") is practically anhydrous, and the original colour of the yellow ochres can be darkened to various shades, during their manufacture into pigments, by the application of different degrees of heat. Their suitability for the production of particular hues, however, further depends upon the proportionate amounts of lime and alumina they contain.

Oxford, Roman, and stone ochres are also favourite pigments, but the finest of all the ochres as pigments, being free from the opacity of the rest of the class, are the famous *umbers* (from Umbria in Italy), and especially the *terra di sicca* of that region, used either as raw sienna or burnt sienna by artists, and forming in both forms one of the most valuable possessions of the colour-box.

OCHROMA is a genus of plants belonging to the order *MALVACEÆ*, and tribe *BOMBACEÆ*. The discoverers of America were astonished to find the natives using rafts made of such light wood that it was impossible to sink them. These rafts were called *balsas*, and so the tree from which they were made (*Ochroma lagopus*) was called also *balsa*; it is, however, generally known as cork-wood. This tree grows in the West Indies and Central America, and the wood is also used as corks for bottles and as floats for fishermen's nets. The specific name *Lagopus* is the Greek for hare's foot, from the appearance of the fruit—a brown hairy capsule, 10 or 12 inches long, splitting up when ripe by five valves, and disclosing the long silky cotton which clothes the numerous seeds. The cotton is used for stuffing cushions.

O'KEGHEM (or **OCKENHEIM**), **JOHANNES**, one of the greatest masters of the early Netherlandish school of music, was born at Termonde in Flanders about 1420. He rose to fame in Antwerp, and was invited to become chapel-master to Charles VII. of France. His favour continued under Louis XI., who rewarded him with church sinecures at Tours, &c. He died there in 1513. A few of his masses and motets are readily available, but are too antiquated to be beautiful to modern ears, though they extort admiration for their extreme ingenuity of musical artifice. He was very famous as a teacher, and was, through his most distinguished pupil, Josquin des Prés, the father of modern music.

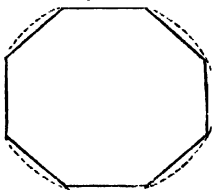
OCKLEY, SIMON, a distinguished but unfortunate scholar, was born at Exeter in 1678. He entered Queen's College, Cambridge, in 1696, and animated by the example of Pecoche and Prideaux, devoted himself assiduously to the study of Oriental languages. He took orders and obtained the living of Swavesay, in Cambridgeshire, and in 1711 he was chosen professor of Arabic at Cambridge. He married early, and the expenses of his family involved him in debt and difficulties, in spite of which he continued to pursue his investigations into Oriental philology and antiquities with the utmost enthusiasm. His most important work was a "History of the Saracens," of which the first volume appeared in 1708, and the second in 1718, the preface of the latter being dated from Cambridge Castle, where the author was a prisoner for debt. Deficient in the critical faculty he wrote his history from Arabic MSS. which were rather historical romances than sober history, but his book received high commendation from Gibbon. Ockley seems to have obtained his release soon after 1718, though it is not known by what means, and he died at Swavesay, 9th August, 1720. His scholarship and troubles form the subject of a chapter in D'Israeli's "Calamities of Authors."

O'CONNELL, DANIEL the Irish "Liberator," was born at Derrynane, near Cahirciveen, Kerry, 6th August, 1775. His father, Morgan O'Connell, a small landed proprietor, was a member of an old Catholic family which had been deeply implicated in the rebellion of 1641, and which had sent several recruits to the celebrated Irish brigade in the service of France. He was educated at a school in Cork and at the College of St. Omer, where the president, Dr. Stapleton, writing in 1792, prophesied that the young student was destined to make a remarkable figure in the world. The French Revolution forced him to return to Britain, and he entered as a student at Lincoln's Inn, being called to the Irish bar in 1798. He soon rose in his profession, and in a few years his thorough knowledge of law, dexterity in conducting cases, wonderful skill in examining witnesses and winning over juries, had advanced him to the first rank, and secured him an income of £8000 a year. He was also soon drawn into public life, and began to devote a large portion of his time and ability to the formation of a strong and united Catholic party, in order to obtain the removal of the disabilities under which the Catholics of Ireland were placed. After several years of arduous labour he succeeded in carrying out his purpose, and the Catholic Association formed by him became a power which English statesmen of all parties were forced to recognize. As he was the life and soul of all the movements which aimed at the repeal of the restrictions placed upon Catholics, he was the centre for all the abuse of the opposite party, and at one time an attempt was made to have him shot. In 1815 a member of the Orange municipality of Dublin, Mr. D'Esterre, challenged him, and a duel was fought in which Mr. D'Esterre was killed. In 1828 he brought the conflict with the British government to a climax by successfully contesting the county Clare, and when elected presenting himself at the House of Commons and refusing to take the oaths specially framed to exclude Roman Catholics. The excitement caused in Ireland when he was refused admission was so great that, afraid of civil war, Peel and Wellington yielded, and carried the well-known Catholic Emancipation Act. In 1829 O'Connell, re-elected for Clare, took his seat in the House of Commons, and from that day till his death continued a member of Parliament. To enable him to relinquish his profession and devote his whole time to his parliamentary duties an annual subscription, styled "O'Connell's rent," was raised for him by his Irish admirers. He was frequently in opposition to the first reform ministry of Earl Grey, but after the Whigs had been succeeded in office by Sir Robert Peel and his party, the former found

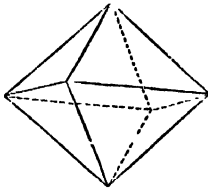
it expedient to secure the support of O'Connell and the pliancy of Irish members who supported him, and after some negotiations the celebrated "Lichfield House compact" was formed which resulted in a union that lasted some years. In 1841, after the return of Sir Robert Peel to power, O'Connell began anew the agitation for the repeal of the union with which he had entered public life, and very soon roused Ireland to a condition of intense excitement. Monster meetings were held in different parts of the country, and at last these became so dangerous to the public peace that the government interfered, and after proclaiming a vast intended meeting for the 8th October, 1843, as unlawful, arrested O'Connell, with ten or twelve of his principal followers, on the charge of seditious conspiracy. After a long trial he was convicted (February, 1844), and sentenced to a year's imprisonment and a fine of £2000. This judgment was reversed by the House of Lords in September, 1844, and O'Connell was discharged; but his arrest had broken the spell of his power, his health had given way, and there had arisen in the ranks of his followers a spirit with which he could feel no sympathy. In 1846 many of his fellow-agitators openly broke with him, being eager to try the effect of rebellion, while he remained steady to his determination never to appeal to physical force. He was still supported by the Roman Catholic clergy and gentry, but he felt keenly the waning of his popularity with the masses of the nation. With the advent of the Irish famine the repeal movement wholly collapsed, and O'Connell, deeply pained by the condition of his country, left England in the March of 1847 to pay a visit for devotional purposes to Rome, and on his way thither he died at Genoa, 5th May, 1847. He had married in 1802 his cousin Mary O'Connell, by whom he had three daughters and four sons.

(See his son John's "Life and Speeches of Daniel O'Connell," two vols., Dublin, 1846-47; Fagan's "Life and Times of Daniel O'Connell," two vols., Cork, 1848; "Personal Recollections of Daniel O'Connell," by W. J. O'N. Daunt, 1848, and the centenary edition of his life published in 1877.)

OC'REA, sometimes spelt *Ochrea* (Lat., a logging), is a term used in descriptive botany to express those stipules which grow together by their back and front edges in such a way as to form a tube, through which the stem passes. The genera *Polygonum*, *Rheum*, and *Rumex* offer a common illustration of this structure.



Regular Octagon, inscribed in a circle.



Regular Octahedron.

OCTAGON, a Greek term used to express a regular polygon of eight sides. The angle between two sides is equal to three half right angles, or 135°.

OCTAHEDEON (Gr. *októ* and *hedra*, a side), a plane rectilinear eight-angled figure. The regular octahedron is bounded by eight equal equilateral triangles. Each of its six corners or solid angles is formed by the meeting of four equal plane angles, and it has twelve edges. Many substances crystallize in octahedra.

OCTANS HADLEIA'-NUS (the instrument invented by Hadley for solar observa-

tions, in the form of an *octant*, or eighth part of a circle), the name bestowed on a southern constellation by Lacaille. It surrounds and includes the south pole. See **PLATO CONSTELLATIONS**, Southern Hemisphere.

OCTAVE (Lat. *octavus*, eighth), in ecclesiastical phraseology, the eighth day after a feast (including the feast day and the intervening group of days). Thus, at Easter, the first Sunday after Easter Day is an octave; and the octave of Christmas is the Circumcision (January 1), the *octava natalis Domini*. The custom originated in the first ages of Christianity, and was in general use up to the Saxon times. It has been revived both by the Roman Catholic Church and by the Anglican High Church party.

OCTAVE, in music (8ve), the interval of the Eighth note (*nota octava*), counting in the prime, in ancient fashion. (In modern counting it would be rather called the Seventh note.) Also the group of notes comprised within this interval.

The octave is readily recognized as a kind of repetition of its prime, and the explanation is now perfectly well known. It requires a string or pipe of half the length of the prime to give the octave; and the vibration of the octave is twice as fast as that of the prime. As the octave is the second partial in a compound tone [see **ACCOMMODATION**], it follows that a large number of partials are common to any two tones at the distance of an octave apart. For instance, 2, 4, 6, 8, 10, 12 of the lower will coincide with 1, 2, 3, 4, 5, 6 of the upper, and of these 2, 4, 8 of the first series, and 1, 2, 4 of the second represent three sounds an octave apart. The most prominent tones, therefore, above any prime (except the prime itself) are actually reproduced in the octave.

This is the ground (though he knew it not) of the musician's hatred of "consecutive octaves," which, when they appear in a piece of harmony, destroy the independence of the parts, and therefore of course destroy the harmony for the moment and convert it into melody at the octave. *Octave* is another name for the principal stop on the organ, an 8ve above the diapason. *Octave Flute* is another name for the Piccolo.

OCTAVIUS, OCTAVIA, OCTAVIANUS. Octavius was the name of an ancient Latin gens or clan, which came to Rome in the early times of the city from the Volscian town of Velitra. According to Roman custom every man of the clan bore the name Octavius, and every lady Octavia. There are many famous Octavii in the history of Rome, generally to be found on the aristocratic side in the state quarrels. The famous Roman emperor Augustus was an Octavius; but being adopted by his uncle, the great Caius Julius Caesar, he took his uncle's name according to the usual formula, with his own family name appended in a subordinate form—Caius Julius Caesar Octavianus. (Augustus was a title—the "august" or "worshipful"—conferred upon him by the senate.)

The most famous Octavia was the sister of the Emperor Augustus, and was married first to Caius Marcellus—her son, the young Marcellus, being formally adopted as his heir by the emperor, who had no sons of his own. His death, B.C. 23, caused Augustus much grief. But before this, in B.C. 40, on the death of her first husband, Octavia had been married again for state reasons to the triumvir Mark Antony. Her beauty, which was as remarkable as the charm of her character, and the warm affection she bore to her brother, were thought to have finally settled the peace of the world, endangered by the charms of Cleopatra; but Antony, on his return to Egypt, gave way to the Eastern queen even more completely than before, and the civil war which placed Augustus at the head of the world was the result. When war was declared Antony divorced Octavia in a somewhat heartless manner. He had forbidden her to accompany him to the East. Her two daughters by Antony became—one the mother of the Emperor Claudius and the grandmother of the Emperor Caius (Caligula), and the other the grandmother of Nero.

Another Octavia was the wife of the Emperor Nero, and the daughter of the Emperor Claudius by the notorious

Messalina. Nero deserted her most basely for Poppæa, whom some time afterwards he married, having divorced Octavia for that purpose. On a false charge the poor empress, probably because she excited the pity of Rome, was banished to the island of Pandataria and there put to death.

OCTET. See OTTET.

OCTOBER, in the year of Romulus, was originally strictly what its name implies, the eighth month, when the year began with March. The Old English name for October was *Wyn-monath* (Wine month). In the French republican calendar the same name was given to it, *Vendémiaire* (Vintage-arians), extending from 22nd September to 21st October.

OCTOPUS is a genus of molluscs belonging to the class CEPHALOPODA and order Dibranchiata (CUTTLE-FISH). The Octopus, Poulpe, or Devil-fish (*Octopus vulgaris*) is found on British shores and on the coasts of the Mediterranean. It is a cuttle-fish with eight arms surrounding the head and united at their base by a broad web. These arms are about twice the length of the body, and are very muscular and flexible. Along their whole surface is situated a double row of circular discs or suckers, which form the chief means by which the animal is enabled to seize its prey. The suckers have around the outside a broad soft band which leaves a cavity in the centre, and to this hollow is attached a muscular piston exactly fitting the aperture, and capable of being worked up and down at the will of the animal. When, therefore, the surface of this sucker is pressed against any substance the withdrawal of the piston creates a vacuum, and powerful adhesion takes place. Having seized its victim by encircling it with its arms, the octopus drags the unfortunate animal to the powerful horny mandibles with which it is furnished, and makes short work of it. These mandibles are similar to the beak of a parrot, and are of great strength, being able to break through the hard shells covering of crabs and lobsters. The octopus swims by contraction of the web connecting the arms; and also, like other cephalopods, by the discharge of water from the funnel. The arms can also be used to crawl about on shore. The shell is internal and rudimentary, consisting of two short plates inclosed in the substance of the mantle. The body is short and thick, covered with tubercles. On being disturbed the octopus discharges an inkly fluid with which it is furnished, in order to cover its retreat. The octopus lies concealed in crevices of rocks during the day, sallying out at dusk in search of prey. The octopus is the "polypus" of Homer and Aristotle; and it seems probable that this animal gave rise to the well-known story of the Hydra.

Forty-six species of octopus and its immediate allies (forming the family Octopodidae) have been described, found chiefly in temperate and tropical seas. Octopods seem, like the squids, to attain gigantic proportions. The genus *Eledone* is distinguished from *Octopus* by having single row of suckers on its arms; a small species is found on British coasts. ("The Octopus, or the Devil-fish of Fiction and Fact," London, 1876.)

OCTROI, a French term which originally meant any ordinance authorized by the sovereign, though it subsequently became restricted to a tax levied in kind on articles of food carried into towns. The *octroi* was afterwards levied in money, and was abolished in France at the Revolution. It was soon re-established, at first as a tax for charitable purposes, but now one-tenth of it goes to the national treasury and the rest to local improvements. It is levied at the gates of all French towns, on all wines, spirits, provisions, coals, &c.; and the collectors have right to search the carriages, parcels, and pockets of those entering the town. The Paris *octroi* alone produces a revenue of nearly £5,000,000 per annum. In Belgium the tax was abolished in 1860.

OCTYL or **CAPRYL** is the eighth member of the alcohol radicle series, having the formula C_8H_{17} . The chloride ($C_8H_{17}Cl$) is obtained by the action of phosphorus pentachloride on octylic alcohol; it is a light, colourless, fragrant liquid, of specific gravity 0.892, and burns with a green smoky flame. It is insoluble in water, but soluble in alcohol. The bromide ($C_8H_{17}Br$) and iodide ($C_8H_{17}I$) are also oily liquids having similar characters, but heavier than water.

Hydrate of octyl, or octylic alcohol, or caprylic alcohol ($C_8H_{17}HO$), is obtained by distilling reeinate of potassium with caustic potash. It is a colourless, aromatic, oily liquid, boiling at 180° C. (356° Fahr.), and having a specific gravity of 0.823. It is insoluble in water, but soluble in alcohol, ether, and acetic acid. Hydride of octyl, or hydride of capryl ($C_8H_{17}H$), is found in American petroleum. It is an ethereal liquid, boiling at 119° C. (246° Fahr.), and having a specific gravity of 0.728.

Octylamine or caprylamine ($C_8H_{19}N$) is a bitter ammoniacal basic liquid, and very inflammable. It boils at 164° C. (327° Fahr.), and has a specific gravity of 0.786. It is insoluble in water, but combines with acids, forming a number of crystalline salts soluble in water, of which the best known is the chloroplatinate ($C_8H_{19}NPtCl_3$). It crystallizes in yellow scales.

Octylene or caprylene (C_8H_{16}) is a hydrocarbon, insoluble in water, but very soluble in alcohol and ether. It boils at 125° C. (257° Fahr.), and burns with a luminous flame. It forms two nitro-derivatives—nitro-octylene ($C_8H_{15}NO_2$) and dinitro-octylene ($C_8H_{14}N_2O_4$). Both are heavy oily liquids.

OD or **ODIC FORCE**. See REICHENBACH.

O'DAL LAW, of Norway, was a land-right of immemorial antiquity of extremely democratic nature, whereby every family estate, even among peasant proprietors, was protected by the law of primogeniture coupled with a right of the head of the family by a forced sale to redeem the odal land at any time from purchasers who might have acquired it. The only exception was when a landowner had left his land or part of it to an executor to pay for his burial, and as this meant anciently burning on a funeral pile, such land was called *brande-erbe*, "burning-land;" in this case the *brande-erbe* became part of the odal land of the executor if he duly fulfilled the burial rites according to his friend's wish.

ODE is derived from a Greek word which signifies a song (*ôdê*, *oidê*), and appears to have been originally applied to any kind of poetry which was written to be sung or accompanied with music. The ode may be regarded as the foundation of lyric poetry, and differs from epic poetry in being confined to the poetic expression of some lofty thought or sentiment, or some burst of imaginative feeling. Rhythm and metre are allowed to change constantly as the nature of the subject requires. Milton's "Allegro" and "Penseroso," Dryden's "St. Cecilia's Day," &c., are examples of the ode in our own language. The acknowledged models of the style, however, are the Greek odes of Pindar.

ODEION, one of the ancient Greek public buildings, the name being perpetuated in the famous second (subsidized) theatre of Paris, the Odeon. An *ôdeion* (Lat. *odeum*) was a music theatre, or as we should call it, an opera-house; and was in consequence of its special musical needs smaller than the great tragic theatres, and roofed over. It served also as a building wherein the chorus for the great theatres could be trained. The largest *ôdeion* was that by Herodôtes Attikos at Athens, which would hold 8000 people. There are ruins of many other *ôdeia* in Greece and Italy.

O'DENSE, a seaport town of Denmark, the capital of the island of Funen, at the head of the Odense Fjord, 85 miles west-south-west of Copenhagen. It is the seat of a

bishop, is well built, and has a fine old Gothic cathedral, containing the remains of Canute, the patron saint of Denmark. It was founded in 1086 and restored in 1300. It has an arsenal, hospital, &c., and manufactures of cloth and iron. It has some coasting trade. Odense is a very old town, said to have been founded by Odin, the Scandinavian hero-deity, chief of the Ases, whose sepulchral tumulus is shown a quarter of a mile north of the town. It was the birth-place of the author Hans Christian Andersen. The population is 18,000.

ODER, a large river of Germany which rises by many streams in the Sudetic Mountains of the Austrian province of Moravia, north-east of Olmütz. It flows south-east and north-east into Prussian Silesia, then with a general north-westerly course past Oppeln, Brieg, Breslau, and Glogau, till it enters the province of Brandenburg. It then flows west by north for about 40 miles, finally turns north, and after a winding course past Frankfurt and Cüstrin, enters the Stettiner-Haff, an arm of the Baltic, at Stettin, in Pomerania. Total length, about 550 miles, including its course through the Stettiner-Haff and Grosse-Haff. Its principal tributary is the Wartha, which joins it from the east at Cüstrin. Area of basin, 45,200 square miles. It is of great importance for inland trade, and is navigable for boats of from 40 to 50 tons as far as Breslau, and for small craft to Ratibor. The Oder is connected to the Elbe by canals, which join the Havel and Spree, tributaries of the Elbe, and the Vistula by a canal from the Netze to the Brahe at Bromberg.

ODESSA, a flourishing and strongly-fortified seaport town in the Russian government of Kherson, is situated on the coast of the Black Sea, about 40 miles west of the estuary of the Dnieper and 30 north from the mouth of the Dniester. It was founded in 1792 by order of the Empress Catharine, on the site of a wretched village, which stood on the north-western shore of the Bay of Adschai. The site is well chosen. The bay is extensive, the anchorage good, and the water deep enough, even close in-shore, to admit large vessels. The bottom is fine sand or gravel, while the bay is seldom frozen, and then only for a short time. The harbour, formed by two moles bordered by a quay, is strongly defended, and is provided with a lazaretto and a lighthouse. The Emperor Alexander appointed the Duc de Richelieu, a French emigrant nobleman, governor of the new town, which, under his judicious administration, rapidly improved. The city is regularly built in the form of an oblong parallelogram, on a declivity sloping towards the sea. The surrounding country is an extensive but treeless plain. The streets are broad and straight, and the town is well paved and lighted. In dry weather the inconvenience from dust along the quay is very distressing. An aqueduct from the river Dniester was constructed in 1874, and a supply of excellent water brought into the town. Altogether Odessa, though said to be one of the better kind of Russian towns, and enjoying a healthy climate during a good part of the year, possesses few recommendations as a place of residence. The expense of house rent and fuel, and of almost every foreign commodity, is excessive. The cold in winter is sometimes extremely severe, a circumstance which, considering the latitude, is seemingly only to be accounted for, as in the case of the great cold in the Canadas, by the exposed aspect towards the north, there being no mountain range to shelter the country from the chilling blasts which sweep down upon it from that quarter. The houses are in general two storeys high, and all built of stone. The finest buildings are—the Russian Cathedral of St. Nicholas, the admiralty, the hospital, the custom-house, the exchange, the theatre, and the bazaar, called *le petit Palais Royal*, which contains 550 shops. There are numerous churches in addition to the cathedral, and about thirty bridges—half of the number being built of wood, and half of stone. There is a fine public garden

in the middle of the city. Between the harbour and the town there is a line of barracks, consisting of sixteen detached edifices. To the north there are magazines of salt and salt meat, and to the west of them reservoirs of water, which are fed by the aqueduct. The chief literary and educational establishments are—the university, with a library of 150,000 volumes; the academy of the Oriental languages; the museum of the antiquities of Southern Russia; a school for noble ladies; a school of navigation; and an ecclesiastical seminary, with cabinets of natural history. The town has open boulevards, a botanic garden, and several baths. On the quay is a statue of the Duc de Richelieu.

The fixed inhabitants of Odessa number about 200,000; there is always a shifting population of several thousand more, partly of sailors belonging to the foreign shipping in port, but chiefly of peasantry and other strangers from the neighbouring country seeking employment on the spot. Of the above number about 60,000 are Jews. They are a thriving race, who are carrying all before them in the commerce of the place. In the eye of the law they now enjoy an equality with the rest of the inhabitants, but are sometimes subjected to mob violence and persecution. They possess several handsome synagogues.

In 1817 Odessa was declared a free port, but the privilege was allowed to expire in 1856. Though not situated at the mouth of any great river, in consequence of its excellent harbour and convenient situation, it is the emporium where the surplus produce of Southern Russia is largely collected for exportation, and where foreign products required for the interior are imported. The products brought down the Dniester, the Bug, and the Dnieper are chiefly exported from Odessa. The close competition of the United States and Canada in the exportation of bread-stuffs seriously affected the Odessa grain trade. The trade, however, still extends to all parts of the Mediterranean and Western Europe, and Odessa contains several hundred great grain magazines. The principal articles of export are wool, tallow, and cereals—chiefly wheat, maize, and linseed. The imports are chiefly cloth, iron, cutlery, machinery, linens, cottons, wine and spirits, provisions, tea, coffee, sugar, &c. Manufactures of woollens, silks, tobacco, soap, and candles are carried on in this city; and there are also some considerable distilleries and breweries. The port is closed by ice on an average for sixteen days every winter.

On the 21st of April, 1851, in consequence of the governor of Odessa firing upon a flag of truce and refusing to give satisfaction, the mole for ships of war and the barracks were destroyed by an attack from the English and French steam frigates. On the 12th May following the *Tiger*, a British steam frigate, ran aground during a fog, was attacked by artillery from the town, and destroyed. In anticipation of war with Turkey, the fortifications of the town were greatly strengthened in 1876.

ODIN or **WOTAN** was the principal deity of the ancient Scandinavians and Northern Germans. [See **WOTAN**.] In all the Scandinavian traditions preserved by the chroniclers, mention is made of a chief called Odin, who came from Asia at some unknown time, with a large host of people called Aser, and conquered Scandinavia, where he built a city called Sigtuna, with temples, and established a worship and hierarchy; he also invented or brought with him the characters of the Runic alphabet; he was, in short, the legislator and civilizer of the North. He is represented also as a great magician, and was worshipped as a god after his death, when some of the attributes of the mythological Odin were ascribed to him; but how much of this is truly traditional, and how much invented to account for the existence of the Norse Olynpus, it is now quite impossible to discover.

ODIN-PONDS is the name given in the ancient Norse sagas and traditions to certain lakes or pools at the foot of high cliffs. Several of them are well authenticated in

Sweden. They were compulsory suicide places for the aged Norsemen in the days of the Vikings; and the evidence for this statement is ample. The saga of Gottrek and Rolf says, "Here by our home is the family-cliff; there our fathers go to Odin without disease. The old folk have free access to that happy spot, and we ought to be at no trouble or charges with them. The children aid their father and mother from the rock, and send them with joy and gladness on their journey to Odin." We know from Geijer, &c., that if the aged Norseman was too feeble to ascend the cliff and take the fatal plunge his kinsmen saved him the disgrace of dying "like a cow in the straw" by beating him to death with "the family-club." Specimens of these clubs are still preserved in Norway and Sweden.

ODOACER, a Goth who aided to make Romulus Augustulus emperor of the West (475). Being dissatisfied with his rewards he marched against Orestes, father of Romulus, who shut himself up in Pavia. Odoacer took the city by storm, and Orestes was carried prisoner to Placentia, where he was executed, in August, 476. Romulus was banished to a castle of Campania, Odoacer proclaimed himself king of Italy, and the Western Empire is considered as having ended thus. Odoacer's authority did not extend beyond the boundaries of Italy. Theodoric, king of the Ostrogoths, having marched from the banks of the Danube, and defeated Odoacer in three great battles, the latter shut himself up in Ravenna, in 489. He was finally compelled by famine to surrender, with a promise of joint sovereignty (March, 493), but was put to death. Theodoric then became king of Italy.

ODOMETR (Gr. *odos*, a road, *metron*, a measure), an instrument designed to measure distance by marking the revolutions of a wheel. In one form it is designed to be attached to the wheel of a carriage, and in another to be dragged after it; but the form most commonly employed is that in which the measuring wheel is fitted with handles, and is drawn or pushed by a pedestrian. In the latter case the wheel is made of such a size that its circumference is an aliquot part of a mile, an arrangement which greatly simplifies the calculations necessary to show the distance traversed. An instrument of this kind is described by Vitruvius in the tenth book of his "De Architectura." In 1550 an instrument of this kind was used to measure a degree of the meridian between Paris and Amiens, with a fair amount of success. The machine was improved by Butterfield in England (1677), Meynier in France (1724), and Hohlfield in Prussia (1760), and it now forms part of the regular equipment of surveyors, &c. An instrument of this kind was employed to measure distances by the British Afghan Boundary Commission in 1884-85.

ODONTOGLOSSUM is a genus of Orchids, tribe Vandeeae. There are over eighty species, natives of the Andes, from Mexico to Bolivia. The flowers are very beautiful, and the plants are much cultivated. The species are epiphytic herbs; the stems are abbreviated, terminated by a one or two-leaved pseudo-bulb. The leaves are few under the pseudo-bulb. The sepals are spreading, free or only slightly attached at the base. The lip is spreading, its claw, often very short, parallel to the column. The column is rather long, and not winged as in *ONCIDIUM*. The anther is single, terminal, opercular, lying horizontally above the rostellum. There are two pollinia. See *ONCIDIUM*.

ODONTOPTERYX, an Eocene fossil bird, described by Professor Owen, from the London clay of the Isle of Sheppey. *Odonopteryx* was probably a web-footed, fish-eating bird, most nearly allied to the Anatidae, the family containing the ducks and geese. It is remarkable for having a saw-like bill, the margins of both jaws being furnished with large tooth-like serrations, which are parts of the bony substance of the jaw itself. The only known species is *Odonopteryx totiapicus*.

ODUSSEUS' (Lat. *Ulysses*), often spelt *Odysseus*, though the Greek language contained no *y*, was one of the most famous heroes of the Greek mythology. His wisdom, or as we should more often call it, his cleverness, occasionally descending to cunning, was as proverbial among the ancients as his sufferings during his long and arduous voyage of ten years after the fall of Ilium. The epithets attached to his name are "the many-counselled" and "the greatly-enduring," i.e. the man of wisdom and varied experience.

Odusseus is known to us by the myths clustering round his name in the Iliad, and by the entire poem of the Odyssey (*Odussea*) devoted to his long travels. Homer makes him the son of Laërtes, king of the island of Ithaka (the modern Ithaki, off the coast of Epirus), who had taken part with Menelaos in the boar-hunt in Kaludon and with Jason in the Argonautic expedition. He married Pénélope, daughter of Ikarios, king of Akarnania, and brother of Tundareos. Pénélope was therefore cousin of the fair Helena about whom the war of Troy was waged. Like Helena, Pénélope was much sought after, and Odusseus won her in the foot-race which the perplexed father had ordained among the many angry suitors. Odusseus had before this been a suitor for the hand of Helena herself, and it was by his counsel that the famous oath was sworn whereby all the suitors pledged themselves to protect her marriage with the happy one who might be chosen. The war of Troy (Ilium) was only possible because of this oath. Many other stories are told of his penetration, and once, when he had greatly assisted the hero Iphitos, the latter gave him the renowned bow of Eurutos, so powerful that scarcely anyone but Odusseus himself could bend it. This he preserved as an heirloom at Ithaka.

When Helena was stolen, and Odusseus knew that Agamemnon and Menelaos were holding all the princes to their oath, he, with a juster estimate of the enterprise than most of them, shrank from the toil. Perhaps even he did not bargain for a twenty years' absence from his home. He was sufficiently alarmed, however, to endeavour to avoid the fulfilment of his oath by feigning madness, and was found by the heralds sowing his fields with salt and ploughing with an ox and an ass yoked together. He was only detected through his infant son Télémachos being placed in the line of the furrow by the herald. The sudden stop of the father's plough showed that he knew very well what he was about. Once embarked in the undertaking he was of the most signal service. He discovered and enlisted the hidden Achilleus [see *ACHILLES*], and he went on a preliminary expedition to Ilium with the injured husband Menelaos, demanding the peaceful return of Helena and the treasure stolen with her. Many other things he did in the siege itself, both as to feats of arms and as to wise counsels, aided always by the constant favour of the goddess Pallas-Athena. It was he who carried off the PALLADIUM from the doomed city; and he who finally devised the scheme of the colossal wooden horse which brought about the fall of Ilium [see *ILIUM*], he himself commanding the storming party concealed within.

After the destruction of Ilium the hero set forth for home with his twelve ships. He was shipwrecked on the coast of Thrace (Ronnelia) to begin with. He valiantly protected himself from the barbarians there; and taking ship again, after a while was driven right across to Libya (Africa) and the Lotos-enters. Embarking again he came to the goat island, where he left eleven ships of his fleet and sailed on alone. Reaching Sicily he was captured by the Cyclops (Kuklops) Polyphémus, who actually devoured some of the hero's companions. He contrived to blind Polyphémus, and to escape very cleverly with his remaining followers, but was pursued by the god Poseidôn, father of the giant. In despair Odusseus sought the help of Aiolos, god of the wind, who gave him bags full of wind, sufficient to carry

him to Ithaka, but the reckless sailors pierced the bags and the ship was driven back. After an encounter with cannibals, Odysseus was next thrown on the island of Aiaia, and fell into the power of the sorceress Kîrkê (Lat. *Circe*), who changed his men into swine; indeed he himself only escaped from a like doom by the help of the god Hêrnês. For love of her visitor, the sorceress eventually relented, and took off her spell. She directed him how to descend to Hades, where he might consult the prophet Teîrêsias as to his return to Ithaka, though she was most reluctant to part with him. This work Odysseus successfully accomplished, and set sail from Aiaia. Passing along the west coast of Italy he encountered the dangerous Sirens, who allured sailors to death with their sweet voices; and resisted this peril by stopping all the ears of his companions with wax. He successfully passed between the rock of Scylla (Gr. *Skulla*) and the whirlpool of Charybdis (Gr. *Charubdis*)—in what we now call the Straits of Messina—and thus entered Greek waters at last. He was sailing fair for home when an act of sacrilege committed by his sailors, who plundered the herds of the god Hêlios, caused his troubles to begin afresh. A fearful storm drove the ship midway across the Ionian Sea, where it was struck by lightning and went down. The goddess nymph Kalypsô (Lat. *Calypso*) inhabited the island Ogugia, and received Odysseus with the greatest kindness. He had been ten days in the water before reaching the island, and was now absolutely alone. Kalypsô offered the hero every temptation to remain with her for ever, even promising him immortality, but succeeded in retaining him only eight years. The gods then took pity on his great desire to return home, and ordered Kalypsô to set him free. As the author of "Télémaque" says at the beginning of his immortal imitation of the Odyssey, "Calypsô ne pouvait se consoler du départ d'Ulysse;" nevertheless she aided him to build a raft, in which he embarked. When off the island of the Phaiakians (perhaps *Korkyra*, the modern Corfu), Poseidôn, long on the watch, managed to shipwreck him. He was tossed almost lifeless on the shore, exhausted by arduous swimming. The king's daughter Nausikaa, playing ball there with her maidens, found him, brought him to life, and conducted him to her father Alkiuôos, who, after treating him royally, when his rank was discovered, sent him home in a ship. At Ithaka no one knew him; it was twenty years since he left the island. His queen had with the greatest difficulty resisted the importunity of over a hundred suitors, who pressed for her hand and lived at her expense, while they threatened her and tormented her with assurances of Odysseus' death. Only an aged nurse, when washing the stranger's feet, recognized him by an old hunting scar. Odysseus made himself known to his son Télémachos as soon as the latter had returned from a voyage in search of his father. By his contrivance Pênelopê agreed to marry whoever could shoot with the bow of Eurutos, belonging to Odysseus, and still hanging unused in the palace. After trials and failures, the unknown beggar was permitted to essay the feat. The bow once in his hand a terrible slaughter began, for the suitors one by one met their death at the hand of the enraged hero, wielding his irresistible weapon. Thus did Odysseus regain his queen and his throne. The relatives of the suitors now rose in war and fell on him from all sides, but Athena interfered and peace was soon made. The Odyssey ends here, and the fate of Odysseus is not revealed. Other myths give it that he was slain unknowingly by his own son Télégonos, whose mother Kîrkê had sent him to seek her lost hero.

OD'YSSEY (*Odusseia*), an epic poem by Homer, in which are related the adventures and wanderings of Odysseus (Lat. *Ulysses*) after the conquest of Troy. See ODUSSEUS.

ECOLAMPA'DIUS, JOHANNES, an eminent reformer, was born in 1482 at Weinsberg, in Wûrtemberg.

His family name was Hussgen, which his learned friends chose to consider as equivalent to Hausschein or Honsclamp, and Gracized into that by which he is best known in history. He was educated at Heilbronn, Bologna, and Heidelberg, and abandoning the study of the law for that of theology, he became tutor to the younger sons of the Elector Palatine. This position he resigned in order to become preacher at Weinsberg, but his desire for learning would not allow him to remain there, and he repaired to Tûbingen, where he became acquainted with Melancthon, to Stuttgart, where he studied Greek under Reuchlin, and to Heidelberg, where he acquired Hebrew from the teaching of a Spanish Jew, named Matthew Adriani. Through the influence of his friend Capito he became a preacher at Basel, where he assisted Erasmus in the preparation of his edition of the Greek Testament. Coming under the influence of the Reformation, after some severe mental struggles, during which he became for a short time a monk, he decided to cast in his lot with the reformers, and settling at Basel in 1522 he spent there the rest of his life as a preacher and professor of theology. Under his influence and that of Zwingle, the Reformation was introduced into all the churches of the city and canton, and also into the university and schools. He died 24th November, 1531.

Ecclampadius was one of the most moderate of the reformers, both in temper and teaching. He took a prominent part in the controversy between Luther and Crotstadt regarding the real presence, his own views concerning the Lord's Supper being almost identical with those of Zwingle. His works were numerous, the most valuable being his commentaries on the books of the Bible.

(See Herzog, "Leben Joh. Ecclampadius u. die Reformation der Kirche zu Basel," 1813; and Hagenbach, "Johann Ecclampadius u. Oswald Myconius, die Reformatoren Basel," 1850.)

GE'DIPUS. See OIDIPOES.

GEIL'ENSCHLAGER, ADAM GOTTLÖB, the most illustrious of Danish poets, and one of the greatest poets of modern times, was born at Vesterbj, near Copenhagen, where his father was organist and steward of the Palace of Fredericksberg, 14th November, 1779. After a desultory education and an unsuccessful attempt to become an actor, he entered the university at Copenhagen as a student of law, and when that city was attacked by the British fleet under Nelson, he served as an ensign in the student corps raised for its defence. After this event, which aroused the dormant patriotism of the nation, he appears to have found the study of law too irksome, and he devoted his energies chiefly to the literatures and languages of Scandinavia. In 1803 he published a volume of poems, and the genius displayed in them at once gave him a high place in Danish literature. They were followed in 1805 by the works entitled "Vandlunders Saga, Langlandsreise, Thors Reise til Jotunheim," and "Aladdin's Lampe," each of which would have made the fame of an ordinary author, and which caused him to be universally recognized as the leading poet of Denmark. In 1805 he obtained a travelling salary from the government, and proceeding to Berlin he completed his tragedy "Hakon Jarl," wrote "Baldur hin Gode," "Palmatoke," and "Axel og Valborg" in Paris; and in 1809 he composed his tragedy of "Correggio" at Rome. In 1810 he returned to Copenhagen, where he married Christiana Heger, the sister-in-law of Rahbek, and received the appointment of professor of aesthetics at the university. Here he lectured and continued his poetical labours, and to the end of his life retained his position at the summit of the Scandinavian Parnassus. In 1829 he was publicly crowned with laurel in Lund Cathedral as the "Scandinavian King of Song," and on his seventieth birthday, in 1849, a grand national festival was held in his honour in Denmark, and he was decorated by the king under circumstances of great pomp. He died

two months afterwards, 20th January, 1850, his funeral being solemnized by the entire nation.

Ehlenschläger's genius was chiefly epic and lyric, but his dramas, especially the earliest of them, display great originality and force of imagination. In all his works he discovers a style at once clear, elevated, and profuse, and some of his epic and lyric productions are among the most exquisite that any literature can boast. He wrote much in the German language, but it is in his purely Danish poems that we find the noblest efforts of his genius, and it is mainly these which have given him his true place in the ranks of the immortals. A complete critical edition of his "Poetiska Skrifter" was edited by Liebenberg (thirty-two volumes, Copenhagen, 1857-65).

CENANTHE, a poisonous genus of plants belonging to the order UMBELLIFERÆ. The species are all inhabitants of damp meadows or watery places, and are common in Europe. The most important is *Cenante crocata* (the hemlock water-dropwort), an inhabitant of ditches, banks of rivers, and similar situations. Cases of accidental poisoning with this plant, in consequence of its roots having been mistaken for parsnips, are not uncommon; but they may easily be distinguished, for the poisonous plant has several tubers.

CENANTHIC ETHER, an ether found in small quantity in all wines, and to which the odour is generally due. It is occasionally used for flavouring wines. It is a mobile liquid of strong vinous odour and disagreeable taste, is insoluble in water, but is soluble in ether and alcohol, and boils at 225° C. (437° Fahr.). The specific gravity is 0.862, and the formula is $C_{18}H_{18}O_2$. It is the ether of cenanthic acid ($C_{14}H_{14}O_2$), an oily acid combining with alkalis to form salts called cenanthates.

CENANTHOL is a mobile liquid obtained by dry distillation of castor-oil. It boils at 155° C. (311° Fahr.). The specific gravity is 0.827, and the formula is $C_7H_{14}O$. It is the aldehyde of cenanthylic acid ($C_7H_{14}O_2$), which is found in the fusel oil from maize spirit, and can be prepared from cenanthol by oxidation. It is a pungent colourless oil, boiling at 148° C. (298° Fahr.), and having a specific gravity of 0.916. It forms a series of crystalline salts, mostly soluble in water, and having the general formula $C_7H_{13}MO$. The anhydride ($C_{14}H_{26}O_2$) is a colourless oil, of specific gravity 0.910.

CENOLIN is a red colouring matter found in red wines. It is very soluble in alcohol, but insoluble in water and ether. The formula is $C_{10}H_{10}O_5$.

GENOTHERA, a genus of plants belonging to the order ONAGRARIÆ. *Genothera biennis* (evening primrose) has large, numerous, and bright yellow flowers. The roots are eatable, and the plant is cultivated in Germany and other countries for the sake of the roots. These roots have a nutty flavour; they are boiled and dressed as salad, or served like salsify, and are considered more digestible than most vegetables. This is the only British species of the genus. They are handsome border flowers, and deserve to be cultivated, but are not valuable on account of any properties they possess. There is one Tasmanian species, but the other species, about 100 in number, are temperate American. The flowers in this genus have a four-lobed calyx, four petals, eight stamens, and one style. The ovary is inferior, with numerous ovules. The flowers open suddenly at twilight and fade the next morning.

ERSTED or **ORSTED**, **HANS CHRISTIAN**, the celebrated Danish man of science to whom the discovery of electro-magnetism is due, was born at Rudkjøbing in Langeland, one of the islands of Denmark, 14th August, 1777. He went to the University of Copenhagen in 1794, and became lecturer on chemistry, &c., in 1800. After visits to Germany, France, and Holland, between 1801 and 1805, he became extraordinary professor of physics at

Copenhagen in 1806. He was elected perpetual secretary of the Royal Society of Denmark in 1812. His great discovery, the work of many years, was published in the Latin treatise "Experimenta circa Electricum Conductum Electrici in acum Magneticum" in 1819; and at once gained him the distinction of the Copley medal from our own Society of Arts (London), the mathematical prize of the French Institute, &c., as well as enthusiastic approbation from all the other scientists of Europe. In 1822-23 Ersted visited Berlin, Paris, London, and Edinburgh, and was everywhere received with great honour. He was very distinguished as a chemist as well as a physicist. In 1828 he became councillor of state in Denmark, and in the following year director of the Danish Polytechnic School. France conferred on him the Legion of Honour in 1837, and Russia the Order of Merit in 1842. Ersted died near Copenhagen in 1851, soon after a grand jubilee festival which celebrated the fiftieth anniversary of his university professorship. His funeral was quite a national solemnity.

OES'EL, an island in the Baltic, stretching across the entrance of the Gulf of Livonia, or Bay of Riga. It extends from south by west to north by east about 45 miles, with an average width of 25 miles; a narrow peninsula extends from its south-western corner about 20 miles southwards. The surface is uneven and rocky, but it is covered with a good layer of vegetable mould.

The winters are much less severe than on the adjacent continent. The island yields corn, flax, hemp, a little tobacco, and very good pasture. Rearing cattle, horses, and sheep, and fishing, are the principal occupations of the inhabitants, who are Esthonians, with some German landed proprietors, and a few Swedes, numbering altogether about 50,000, mostly Lutherans. The seal fisheries are of some importance. The island belongs to the Russian government of Livonia.

GESOPHAGUS or **GULLET** is the canal leading from the pharynx, the short cavity at the back of the mouth, to the stomach. In man it is composed of two layers of muscular fibres, an external longitudinal layer, and an internal, composed of circular fibres, by which the food is propelled towards the stomach, and which are lined by a layer of soft mucous membrane and a moderately thick cuticle continued from that of the lips and mouth.

Diseases of the Oesophagus.—Although this portion of the alimentary canal is liable to a considerable number of morbid changes, it has been observed in practice that none of them are of very common occurrence. The following are the more important:—(1) *Oesophagitis*, or inflammation of the oesophagus, an affection which very rarely appears idiopathically, but which is not unfrequently originated by the direct application of hot, irritating, or corrosive substances, or by mechanical injury from the introduction of foreign bodies. The symptoms are severe pain in the throat, or between the throat and stomach, which is increased by all attempts at swallowing, thirst, and vomiting, attended by considerable fever and constitutional disturbance. Treatment consists in the use of nutritive enemata while the inability to swallow lasts, in attention to the condition of the bowels, in the use of warm poultices externally to relieve pain, and the administration of suitable opiates if required. Although a patient may be unable to swallow ordinary liquids, small pieces of ice may be sucked, and this will often prove agreeable to the patient. (2)

Ulceration of the oesophagus, arising from the passage of irritating fluids or the sticking in the gullet of pointed or angular bodies, a very serious affection, and one that is often followed by grave consequences. Owing to the slowness of the ulcerated surface to heal, the nutrition of the body can hardly be maintained, and the patient may sink from sheer starvation. Sometimes food may be introduced by means of a catheter and the stomach pump, and where this is possible the strength may be maintained

until the affected portion becomes healed. (3) *Stricture of the œsophagus*; this may arise from inflammatory thickening and induration of its coats, or from some new growth, such as that resulting from cancer or syphilis. The symptoms are persistent, and gradually increasing difficulty in swallowing, a feeling as if the food never passed into the stomach, sickness which increases until all aliment is regurgitated rather than vomited; while a bougie when passed always meets with resistance at the same spot. The prognosis in cases of real organic stricture is always grave, and the disease, if unrelieved, must prove fatal either from ulceration of the tube round the seat of the stricture or from starvation. In some forms of the affection the frequent passage of bougies of varying size is often of great service, and food may be administered by the methods already indicated; but where the stricture is due to malignant deposit the introduction of a bougie is inadmissible, and but little can be done beyond alleviating the sufferings of the patient. (4) *Spasmodic stricture of the œsophagus*, which frequently occurs as one of the symptoms of hysteria; this may be readily distinguished from the organic form by the suddenness with which its symptoms manifest themselves, and by the spasmodic form of the affection. Treatment consists in attention to the general health and the use of the usual anti-hysterical remedies.

Occasionally foreign bodies find an entrance into the œsophagus, and becoming impacted there give rise to much pain and danger. A large mass lodged at the entrance of the tube may cause immediate death by spasm of the glottis, but when it becomes lodged lower down there is usually time enough to attempt remedial measures. Sometimes a smart blow between the shoulders given with the palm of the hand will suffice to dislodge the foreign body, and in other cases it may be pushed down into the stomach by the probang. A small body, such as a sharp fish bone, may often be removed by swallowing a large mouthful of bread, and large hard bodies may be extracted by means of the long curved œsophagus forceps or by the probang.

CESTRIDÆ. See BOTFLY.

OFFA, a powerful king of Mercia in the early times after the English conquest. He was at first Alderman of the Hwiccas (Gloucester and Worcester, &c.), and in 755 he became by conquest King of Mercia, being of the old Mercian royal house. He reigned till 796, and raised Mercia to be the chief state of England. In 777 he subdued the King of Wessex, Cynewulf; and in the same year annexed (the present) Oxfordshire, Kent and East Anglia also acknowledged his overlordship. Soon afterwards a great deal of the Welsh (or British) side of Severn was conquered by Offa, and the British town of Pengwern was Englished into Scrobleshryrig (the "borough or town in the Scrub" or brushwood forest), now Shrewsbury. To keep this new territory Offa threw up a great dyke from the mouth of the Wye to the mouth of the Dee, still in part traceable, and still known as *Offa's Dyke*. Offa's Dyke was long the boundary between England and Wales, and indeed remains so to this day in all essentials. For a time under Offa, who had risen into high favour with Rome through his establishment of the church tax called *Peter's-pence*, Lichfield became an archbishopric and the primal see of England, to punish a revolt of Kent; but this lasted only so long as Offa lived, the Archbishop of Canterbury soon after the great king's death procuring the restoration of the old state of things, so that there was never more than one Archbishop of Lichfield. Offa was very friendly with Karl the Great, afterwards the first Frank "Emperor of the Romans," after a severe struggle caused by Karl's interference in favour of Kent; and the first foreign treaty of England was one between these two monarchs relative to the safe-conduct of English pilgrims in their journey across the Continent to Rome.

OFFA'S DYKE is an intrenchment still distinguishable in several of the western counties of England, constructed by Offa, a Saxon monarch, to restrain the inroads of the savage Welsh tribes. It was 100 miles in length, and extended from the Dee to the Wye.

OFFENBACH, JACQUES (probably *Jakob*), a Jewish musical composer of opéras-bouffes, of German extraction, but French by long residence, was born at Cologne in 1819, and went to Paris as quite a boy. Here he studied at the Conservatoire, played the violoncello in the Opera Comique, and eventually became musical director at the Théâtre Français. His first piece, "Pépitto," appeared in 1853, but it was "Orphée aux Enfers" (1858), "Geneviève de Brabant" (1860), the "Belle Hélène" (1865), the "Vie Parisienne" and "Barbe Bleue" (1866), the "Grande Duchesse de Gêrolstein" (1867), &c., which raised Offenbach to the position of the creator of a new variety of musical farce, very gay, very amusing, though not very decent nor very refined; with no pretension to pure musical effects, but yet with scarcely a dull bar. In the corrupt state of French society and French taste just preceding (and in great part causing) the downfall of the second empire, the meretricious glitter of these productions gained an enormous popularity. Some of the melodies and situations are undoubtedly clever in the highest degree, but the whole work is essentially ephemeral. A few of the less indecent examples were translated and had a certain limited vogue in England.

OFFERTORY (Lat. *offertorium*, French *offertoire*), in the Roman Catholic Church, is a portion of a psalm, &c., sung by the choir after the creed at high mass, and usually followed by an organ voluntary of some length, during which the priest makes ready the oblation to offer as a sacrifice upon the altar. Sometimes alms are collected at this time, and contributions towards the services are made on the part of the faithful. This latter custom is what is now known in many Protestant churches as the "offertory," the money offerings of the faithful being collected at a suitable time of the service and presented, and not the sacrifice of the mass itself. The word has come in this way to have two distinct meanings.

Musically an offertory or offertoire is the title of the organ voluntary occurring at the times mentioned; and in the plain-song it is applied to one of the melodies of the *offertoria* appropriated to the various festivals in the liturgy of the Roman Church.

OFFICE, HOLY. See INQUISITION.

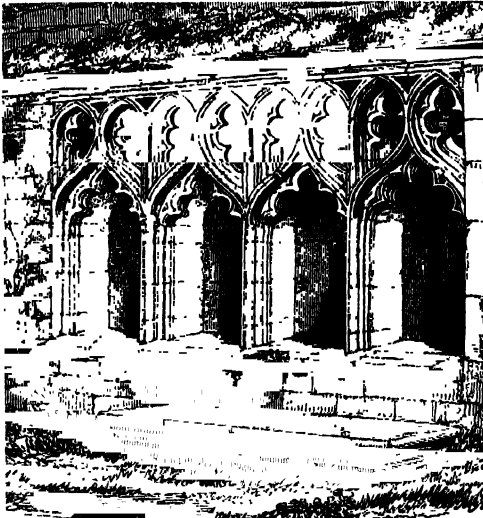
OFFICERS, MILITARY AND NAVAL. Military officers are commissioned, warrant, or non-commissioned. Commissioned officers hold their commissions direct from the crown, and comprise all from the commander-in-chief to the lieutenant, consisting of staff, regimental, general, field, and company officers. Warrant officers are master gunners, schoolmasters, &c. For the others, see **NON-COMMISSIONED OFFICERS**. Naval officers are divided into commissioned, warrant, and petty officers. The first comprise admirals, captains, commanders, lieutenants, and sub-lieutenants; the second description includes boatswains, carpenters, and gunners. Petty officers are analogous to the non-commissioned officers of the army, and are selected from the most efficient and deserving seamen.

OFFING, in navigation, that part of the sea which lies at a considerable distance from the shore, and where there is deep water.

OFFSETS are lines drawn perpendicular to the chord of an arc or the longest base of an irregular polygon, from points in the arc or corners of the polygon. In gardening, a name given to young radical bulbs when separated or taken off from the parent roots; and to short lateral shoots bearing clustering leaves at the extremity. In surveying, short distances from the chain-line, usually measured with a rod, called an *offset-staff*, the most convenient length for

which is 6 feet 7-2 inches, or ten links of the surveying chain.

OGEE or **OGIVE**, a double curve or curve with two flexures. The common contraction "O.G." would perhaps imply (as many carpenters really believe) that the curve was named as combining parts of these two round letters. The word is, however, simply the French *ogive*, which came originally from the Spanish *auge*, the point of the doubly curved or "ogival" Moorish arch, the Arabic term for which is *awj*. Gothic architecture is in general termed "ogival" in France, even when its arches are simply pointed and not ogival in our sense of the word. The ogee is of frequent use in Gothic architecture, not so much in arch-contours as in moulding-contours; and in the latter position it is also of constant occurrence in classical architecture,



Ogival Arches, Paisley Abbey.

under the name of the *cyma*. A description of several varieties of the *cyma*, its reverse the *talon*, &c., is given in the article GREEK ARCHITECTURE, with figures.

The most beautiful examples of ogival arches are to be found at Venice, where Moresque forms enter largely into the architecture and give a peculiar splendour to the Venetian variety of the Gothic style. The ogival form is also very characteristic of the latest French Gothic, the magnificent *flamboyant* style. Examples are not so frequent in our own country, but beautiful specimens are not wanting. Annexed is an elegant design of cusped ogiva arches over a row of sedilia, in the ruins of Paisley Abbey.

OGHAM (pronounced *owam*) is the name given to the rectilinear characters of the ancient Irish and other Celtic nations. The origin of the name is unknown. Cork and Kerry contain the most numerous examples, and West Wales also possesses several monuments inscribed with Ogham characters. In Scotland the Newton and Logi stones in Aberdeenshire contain Oghams, and there are examples in Shetland and elsewhere. Except on one stone in Devonshire, no Ogham inscriptions have been found in England. Oghams may be written along a line, and occur thus on parchment, coins, bones, &c., but by far the most usual way is to sculpture them on the edges of the faces of a squared stone, the square corner itself serving for its dividing line. The principle of the Ogham writing is in its nature variable. It was probably an occult, or perhaps

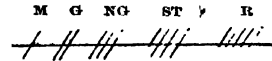
sacred method of writing; consequently each tribe or group of priests would have its peculiar alphabet. At least eighty forms are known. Four varieties of signs divide the alphabet, and in a specimen in the British Museum they occur as follows:—

Strokes below the line.

Strokes above the line.

Strokes across (vowels). - +

Oblique strokes.



The alphabet, having B (*beith*) and L (*luis*) as its first two letters, is called properly *Beithluisinis* in native speech. The inscriptions are read from left to right, or, in the usual vertical position, from bottom to top, the lines on the right face of the stone being deemed to be above the line, and those on the left face of the stone being read as below the line, the corner serving, as said before, for the line itself. If there are more lines than one in horizontal reading, the method called by the Greeks *boustrophedon* is employed; that is, the first line being read from left to right, the second is read from right to left, and so forth. In the stone inscriptions the line of carving is carried across the top and down the opposite corner, whence it is manifest that on a square pillar such as that in the sketch, where four corners are used, no less than four ways of reading are admissible. It becomes a matter of difficulty to hit on the right one, since all the words run together without any stop or division. A subject so bristling with difficulties, and so ill-rewarding the successful discoverer (for all the inscriptions read are mere bare statements without any particulars of the names of the chief in memory of whom the inscription was written), may readily be supposed to be still obscure. Though there are many genuine Celtic inscriptions in Oghams, the bulk show traces of Latin corruptions and bear Christian emblems, and indeed the use of these characters as a secret alphabet continued far into the middle ages. It is said to have been used by Charles I. in his reasonable correspondence with the Irish chiefs.

OHIO, THE, one of the most important rivers of the United States, the second largest of the tributaries of the Mississippi, called by the French *la Belle Rivière* (the beautiful river), the Indian appellation, Ohio, being said to have the same meaning. It is formed by the junction of the Alleghany and Monongahela rivers at Pittsburg, in Pennsylvania, and flows in a circuitous course north-west, south, south-west, west, and finally south-west to the Mississippi, which it joins in lat. 37° N., lon. 89° 10' W., having formed the boundary between Ohio, Indiana, and Illinois on the north, and West Virginia and Kentucky on the south; length, nearly 1000 miles. Area of basin, including the greater part of the states of Ohio, West Virginia, Indiana, Kentucky, and Tennessee, with portions of Pennsylvania, Virginia, Illinois, North Carolina, and Alabama, about 214,000 square miles. The principal tributaries are on the right bank, the Big Beaver, Muskingum, Scioto, Miami, and Wabash; and on the left bank the Great and Little Kanawha, Sandy, Licking, Kentucky, Green, Cumberland, Tennessee rivers, the last a very large stream. Its medium breadth is 606 yards, at Cincinnati 1600 yards; at Pittsburg it is 680 feet above the level of the Gulf of Mexico, at Cincinnati 414 feet, and at its confluence with the Mississippi 291 feet, showing an average fall of rather less than 5 inches in a mile. The

velocity of the current is about 8 miles an hour; but in some parts there are rapids, particularly at Louisville in Kentucky, where a canal has been constructed which admits steamboats. The winter level is from 50 to 60 feet above the average height in summer, and for five or six weeks in spring navigation is completely interrupted by masses of floating ice. Small vessels and steamers adapted to the least possible draught of water ascend it to Pittsburg, below which town the scenery is for some distance very picturesque, the banks, 200 to 300 feet high, being wooded or covered with verdure; but it becomes tame in the lower part of its course.

OHIO, one of the United States of North America, extending from east to west 220 miles, and from north to south from 93 to 200 miles; its average breadth is about 182 miles. It is bounded west by Indiana, north by Michigan and Lake Erie, east by Pennsylvania, south-east by Virginia, and south by Kentucky. The area is 40,760 square miles, and the population in 1880 was 3,197,794. The state contains an unusually large number of Germans and their descendants.

Surface and Soil.—The surface of the state of Ohio may be divided into the hilly and the prairie region. The former comprehends the eastern and southern districts, and may be considered as separated from the latter by a line commencing at the most north-east point of the state on Lake Erie, and running in a S.S.W. direction to Zanesville on the river Muskingum, whence it extends due west and terminates on the boundary-line of Indiana near Eaton. The hilly region contains some level and low land along the Ohio, but the level land does not extend more than $1\frac{1}{2}$ mile from the bank of the river. It is very fertile, though in some parts swampy and subject to inundations. Behind this level tract the surface rises suddenly into steep hills, which in general range between 300 and 500 feet above the level of the river. From their summit the country extends in an uneven hilly plain furrowed by valleys. The general elevation of these uplands varies from 800 to 1000 feet above the sea-level. The soil of the valleys is very deep; that of the uplands is not so deep, though more so than is usually found in hilly regions. The prairie region is an extensive, elevated, and tolerably level plain. Other parts contain large tracts of flat country, where scarcely an undulation of the surface can be discovered. The general elevation of this region hardly exceeds 1000 feet. This plain contains the watershed between the rivers which run southward to the Ohio and northward to Lake Erie, and its surface presents an alternate succession of woodlands and prairies. Along the south-western shores of Lake Erie there is an extensive tract called Black Swamp. The valleys are generally very fertile, and altogether about nine-tenths of the state are fit for cultivation.

Rivers and Canals.—The river OHIO runs along the eastern and southern boundary line of the state. The Muskingum, the Scioto, the Great Miami, and the Little Miami, are all affluents of the Ohio. The state is well provided with canals, the total length of canal communication amounting to an aggregate of nearly 1000 miles.

Climate, Productions, &c.—The mean annual temperature at Cincinnati on the Ohio is $54^{\circ}6'$, or about $3^{\circ}56'$ higher than that of London. The mean temperature of the winter at Cincinnati is $34^{\circ}5'$; at London, $39^{\circ}3'$. Most of the rivers, including the Ohio, are covered with ice every winter. The greatest quantity of rain falls in April and May.

The wealth of Ohio, which is rapidly becoming a thickly settled country of moderate-sized freeholds, consists chiefly in its agricultural productions. Indian corn, wheat, rye, oats, barley, and tobacco are extensively cultivated. Most of the fruit trees of England succeed well, especially peaches. The wild grape grows luxuriantly on the southern side of the hills; and several vineyards have been planted,

from which pretty good wine is obtained. The cultivation of the grasses is not neglected. Horned cattle and pigs are very abundant, and are driven in great numbers to the Atlantic states for sale, or sent down the Mississippi. Salt pork also constitutes an important article of exportation. Iron ore abounds, and is worked in a few places not far from the river Ohio. The whole eastern part of the state is one vast coal bed; lime and marble are also worked. Salt is obtained from springs on the river Scioto, and some oil springs have been opened.

Ohio takes the lead among the western states for manufacturing industry. Cotton and woollen stuffs and yarn, iron, glass, and cabinet wares, paper, oils, and articles of clothing, are made in all the principal towns. Ship and steamboat building is also extensively carried on, principally at Cleveland and Cincinnati. Columbus is the capital.

History and Constitution.—This state was first visited by the French from Canada in the seventeenth century, but no settlements were formed till the British from Pennsylvania and Virginia began to occupy the land. The French sought to prevent this by establishing small forts from Presque Isle on Lake Erie to the Ohio along the channel of the river Alleghany. This, however, was considered by the British government as an encroachment, and it led to the war of 1755, by which the French lost Canada, and were expelled from North America. In 1799 the first territorial legislature met at Cincinnati, and organized the government. In 1802 Ohio was admitted into the Union, and formed a constitution.

OHM'S LAW, OHM (measure). The law of the strength of an electric current was first discovered by Dr. G. S. Ohm. "Strength of current" means the quantity of electricity, as measured by amperes, flowing past any point of the circuit in one second; and Ohm's discovery was that the strength of current varied *directly* as the electromotive force (E.M.F.), and *inversely* as the resistance of the circuit. Therefore either an increase in the E.M.F. of the cell, or an improvement lessening the resistance (R) of the wire forming the circuit (or the internal resistance in the cell itself), or any combination of these two, will increase the strength of the current (C). The law may be stated in symbols thus:—

$$C = \frac{E}{R}$$

and with greater exactness thus:—

The number of amperes of current equals the number of volts of E.M.F., divided by the number of ohms of resistance in the entire circuit (including the battery itself).

The *ohm* is the practical unit of electrical resistance, and is equal to 10^9 absolute units of resistance. The latter expression is the value of the resistance of a conductor when unit difference of potential (i.e. of E.M.F.) between its ends causes a current of unit strength (unit quantity per second) to flow through it; and this value is so small as to need multiplication by 1,000,000,000 to reach a conveniently measurable quantity. The ohm may be expressed in terms of velocity as 10^9 centimetres or 1,000,000,000 metres (one earth-quadrant) per second. In practice the ohm is measured by certain standards of German-silver wire coils of a precise size and length, through which the current is passed for testing, but careful measurements at the Electrical Congress of Paris in 1881 showed that the usual coils resisted .9895 of an ohm only. It is most probable that a suggestion of the late Dr. Siemens will therefore be adopted for making the standard ohm in the future. This is a column of mercury, a square millimetre in section, a metre's length of which resists .9536 of an ohm. An exact ohm of resistance can be ascertained with precision in this medium; it will be given by a (millimetre) column 1.059 metre in length.

OIDIPOUS, the "swollen-foot" (Lat. *Œdipus*), is the name of one of the most famous personages of the Greek heroic mythology. It was given to him because his father Laios, son of Labdakos, king of Thebes, having been informed by an oracle that his new-born babe would be the cause of his death, pierced the feet of the infant, tied them together with a rope, and ordered the little one to be thrown upon the side of the mountain, there to perish of exposure. But the poor babe with its swollen feet was found by a shepherd, who took it to the King of Corinth, by whom Oidipous was brought up as his own child. To penetrate the mystery of his birth the prince made a journey to Delphi and consulted the oracle. To his horror he was told that his destiny was to slay his father and commit incest with his mother. Thinking that the good King of Corinth was referred to by the oracle, Oidipous at once resolved never to see him more. Wandering homeless away from Delphi he met Laios, who angrily disputed the way with him, and in the ensuing scuffle Laios and his charioteer were slain. Oidipous reached Thebes not knowing the name of the man he had killed. The city was in great trouble both for the prolonged absence of its king and the ravages of the Sphinx, a female Centaur-like monster, a compound of giantess and lioness, who daily came to a rock near Thebes and put enigmas to the passers by, slaying and devouring those who failed to guess the answer. The Thebans at length declared that he who should deliver them from the Sphinx should marry the Queen Iokasta, now deemed on all hands to be a widow, and become king of Thebes. This was accomplished by Oidipous, who received as his riddle from the Sphinx the famous description of "A being with four feet, two feet, and three feet, but only one voice, weakest when it has most feet." The answer was correctly given, as "Man, who crawls at first on all fours, then walks erect, and finally is obliged to use a staff in old age," and on hearing it the Sphinx threw herself in rage from the rock and was killed. Children were born to Oidipous and his mother-wife, two sons, Eteoklés and Poluneikés, and two daughters, Antigônê and Ismênê. Disasters which overtook the country caused Oidipous to consult the prophet Teiresias, and thus at last learn the awful sins at his charge. Frantic with despair he put out his eyes as unworthy to behold longer the light of heaven, and at once quitted Thebes. Iokasta strangled herself. Kreôn, brother of Iokasta, who had acted as regent during Laios' absence of old, now assumed the regency for the sons of Oidipous, and warned by an oracle he brought back and detained the unhappy king in the land. But when the sons were grown up, they and Kreôn thrust out Oidipous, who, attended by his loving daughter Antigônê, the favourite heroine of Greek tragedy, wandered over Greece begging his bread. Meanwhile the sons quarrelled, and Eteoklés drove out Poluneikés from Thebes. The latter prepared a great army with the help of six princes (the famous "Seven against Thebes"), and hearing from an oracle that the side which Oidipous should favour would win, he sought out his aged father, whom he found at Kolonos, near Athens, having just received a cordial welcome and promise of relief from all future misery at the hands of the generous Theseus. Hardly had the indignant father driven away his unworthy son than Kreôn, moved by the same oracle, arrived with soldiers, seized the blind old man and his daughter, and proceeded to drag them away to Thebes. Theseus arrived in time to prevent this last injury. For all the benefits of the great Athenian prince Oidipous gave ample return. Theseus accompanied him into a grove and there alone saw him die, receiving from him promises of eternal protection for Athens so long as his grave was kept secret and preserved from dishonour. As for his sons, the dying king solemnly cursed them, and foretold their death by each other's hand. See **ANTIGONÊ**.

OIDIUM (Gr. *oideō*, to swell), the vine mildew, a destructive disease to which grapes of late years have been subject, and which is now known to originate in the attack of a kind of fungus, called *Oidium Tuckeri*. Oidium is now found to be only a stage in the growth of a species of Erysiphe. The specific name is derived from Tucker, the name of a gardener at Margate who first used sulphur as a remedy for the disease.

OIL BEETLE. See **MELONIDE**.

OIL BIRD. See **GUACHARO**.

OIL GAS, a gas introduced some years ago, and then made on the large scale; it was compressed into iron cylinders, and sold as "portable gas." It was made by dropping a fatty oil into a red-hot iron retort, and collecting the gas; it has a high illuminating power. This manufacture has long ceased, but the same process has recently been adopted with crude petroleum; it gives a richly luminous gas, very pure, and quite free from sulphur.

OIL OF VITRIOL. See **SULPHURIC ACID**.

OIL-CAKE, the crushed residue remaining after the oil has been pressed out from certain seeds. As this cake always retains a large percentage of the oil, together with nearly all the albuminous matter, sugar, gum, and the starchy components of the seeds, it possesses a high nutritive value, and forms a valuable food for cattle and sheep. The richest and best of the cakes used in this way are those obtained from ordinary linseed, next to which in value come rape, cotton, and palm cakes. Other kinds are hempseed, poppy-seed, gold-of-pleasure seed, &c., but these are of lesser importance. The cotton-seed cake, when the husks of the seed have been removed before crushing, forms a very valuable food stuff, and immense quantities are imported into Great Britain from the United States.

OIL-PALM. See **ELÆIS**.

OILS. The term oil is used to designate numerous liquid or semi-liquid substances obtained by a variety of methods from very different sources. In its most comprehensive sense it includes solid and even hard substances, such as fat, tallow, and wax, the thick fluid fixed oils, the odorous essential oils, and the volatile oils or hydrocarbons obtained chiefly by the destructive distillation of mineral substances. For an account of oils of the latter class see under *Hydrocarbon Oils* below.

Fixed oils, from which the fats are only distinguished by being solid at ordinary temperatures, chemically considered, are compounds of glycerin with certain fatty acids, the more important of which are known as oleic, palmitic, stearic, linoleic, and phytosteleic acids. There are numerous other fatty acids found, in combination with glycerin, in oils, but with those mentioned they are all compounds of carbon, hydrogen, and oxygen; some of them, like oleic acid, are fluid at ordinary temperatures, while others, such as stearic acid, form solid crystalline bodies.

In a pure condition most oils have scarcely any characteristic colour, taste, or smell, and, with few exceptions, they possess no active physiological properties. Among their physical properties the more prominent are their viscosity, insolubility in water, and their being lighter than that fluid. The viscosity of some of the fluid oils is very considerable, that of castor oil, which at a temperature of 15° C. flows more than two hundred times more slowly than water, being perhaps the most extreme instance. Olive oil at the same temperature flows about twenty times as slowly as water. Oils give to paper, which they render translucent, a permanent stain; they are not volatile at the ordinary temperature of the atmosphere, or indeed at any temperature insufficient for their decomposition, and nearly all of them, when exposed to the air, absorb oxygen readily, and either gradually harden or become rancid and nauseous. The whole of the fixed oils, when heated to their boiling-points, 500° to 600° Fahr., suffer decomposition, yielding various hydrocarbons, and when

suddenly exposed to a red heat they furnish a gaseous product, which is capable of being used for illuminating purposes. With the caustic alkalies and water they unite to form soap. Their property of absorbing oxygen is sometimes a source of danger, for when they are absorbed by porous bodies by which an extensive surface is exposed to the air, they are apt to generate sufficient heat to produce spontaneous combustion. Tow, cotton-waste, wool, &c., impregnated with oil and left in a heap freely exposed to the air or sun often burst into a flame, and in this way many

extensive fires have arisen. Linseed, rape, and olive oil are especially liable to produce this result. The specific gravity of all oils is lower than that of water, ranging between .865 to .970, water being 1.000.

The fixed oils and fats are most widely distributed in animal and vegetable life, being chiefly found in the fruits and seeds of plants and in thin membranous cells, forming what is called adipose tissue in the bodies of animals.

In the following table we give a list of the more important oils and fats ordinarily met with in commerce:—

Name of Oil.	Obtained from	Principal Use.
ANIMAL OILS—		
Whale,	Various species,	Burning, lubrication, &c.
Sperm,	<i>Physeter macrocephalus</i> or spermaceti whale,	Lubrication.
Seal,	Various species,	Burning, lubrication, currying leather, &c.
Coil,	Livers of <i>Gadus morrhua</i> , &c.,	Medicinal, currying leather.
Fish,	Various fish,	Burning, lubrication.
Neat's-foot,	Feet of oxen,	As a lubricant for fine machinery.
DRYING OILS—		
Linseed,	<i>Linum usitatissimum</i> ,	Paint, varnish, linoleum, &c.
Candle-nut,	<i>Aleurites triloba</i> ,	Burning, paint, soap.
Gold of Pleasure,	<i>Camelina sativa</i> ,	Burning, soap.
Poppy,	<i>Papaver somniferum</i> ,	Food, paints, soap.
Sunflower,	<i>Helianthus annuus</i> ,	Food, paints, soap.
Madia,	<i>Madia sativa</i> ,	Burning, soap, lubrication.
Niger,	<i>Guizotia oleifera</i> ,	Soap, lubrication.
Safflower,	<i>Carthamus tinctorius</i> ,	Food, burning.
Hemp,	<i>Cannabis sativa</i> ,	Lubricant, varnish.
Nut,	<i>Juglans regia</i> ,	Food, oil-painting.
NON-DRYING OILS—		
Ground-nut,	<i>Arachis hypogea</i> ,	Food, soap.
Cotton-seed,	<i>Gossypium</i> (species),	Soap, lubrication, to adulterate olive oil.
Colza,	<i>Brassica campestris</i> ,	Burning.
Rape,	<i>Brassica campestris</i> (variety <i>Napus</i>),	Burning, lubrication.
Olive,	<i>Olea europaea</i> ,	Food, burning.
Gingelly,	<i>Sesamum orientale</i> ,	Food, soap-making.
Almond,	<i>Amygdalus communis</i> ,	Medicine, perfumery.
Castor,	<i>Ricinus communis</i> ,	Medicine, soap, lubrication.
Croton,	<i>Croton Tiglium</i> ,	Medicine.
VEGETABLE FATS—		
Cocoa-nut Oil,	<i>Cocos nucifera</i> ,	Soap and candles.
Palm Oil,	<i>Elæis guineensis</i> ,	Soap and candles.
Palm-seed Oil,	<i>Elæis guineensis</i> ,	Soap and candles.
Vegetable Tallow (Chinese),	<i>Stillingia sebifera</i> ,	Soap and candles.

In reference to the foregoing table notices of some of the more important oils are given under their own headings or under the name of the producing material. [See COCOA-NUT PALM, COD-LIVER OIL, CROTON, &c.] *Whale or train oil* is obtained by melting the blubber of the animal. As met with in commerce, it is of a brownish colour, rather viscid, and has a disagreeable fishy smell and taste. Its specific gravity is about 0.927. *Sperm oil* is obtained from an oily matter lodged in a bony cavity of the head of the *Physeter macrocephalus* or spermaceti whale. When this substance is subjected to pressure in bags a quantity of pure limpid oil is expressed; and the residue, after being melted, strained, and boiled with a weak solution of potash, forms the well-known animal wax, *spermaceti*. *Seal oil* is obtained from the blubber of nearly thirty varieties of seal. A full-grown seal will yield from 8 to 12 gallons of oil, a small one 4 to 5 gallons. The *pale seal oil* of commerce is that which drains from the blubber before putrefaction commences, and this when refined ranks close after

sperm oil. *Brown seal oil* is that which drains from the mass after fermentation and putrefaction have set in. It has a strong disagreeable odour, nauseous taste, and it gives off much smoke in burning. Under the name of *fish oil* are included all the oils obtained by boiling fish refuse or entire fish which are not used as food. *Neat's-foot oil* is obtained by boiling the feet of the common ox, the fat being skimmed from the surface of the water and allowed to settle, when the oil can be drained away. A large quantity is exported from the River Plate region in South America. *Gold of pleasure*, *German sesame*, or *Camelina oil* is produced and consumed chiefly in Germany. *Poppy oil* is yielded by the seeds of the opium poppy, and it forms an important article of food in the valley of the Ganges, where opium is chiefly cultivated. The cold-pressed oil is very sweet and pleasant, the hot-pressed oil being more suitable for manufactures. From its good drying properties it is highly esteemed by artists. *Sunflower oil* is clear, pale-yellow, and tasteless, and is much esteemed as food

in the east of Russia. *Madia oil* is obtained from the *Madia sativa*, a plant introduced into Europe from Chili on account of its oil-yielding properties. It occupies a place intermediate between drying and non-drying oils. *Niger oil* is the produce of a plant largely cultivated throughout India, where it is much used by the poorer sections of the population as a substitute for ghee. When imported into Europe it is chiefly employed as a lubricant and in soap-making. *Nut oil* is obtained from walnuts or hickory nuts. It is pale, mild tasted, very fluid, and has strong drying properties, rendering it peculiarly suitable as a vehicle for oil colours. *Ground-nut oil* is largely used as a substitute and adulterant of olive oil, and it forms the principal staple of the soap-making industry of Marseilles. [See ARACHIS.] *Cotton-seed oil*, obtained from the decorticated seeds of cultivated cotton, was first introduced in 1852, and successive improvements in its manufacture have made it one of the most important vegetable oils of commerce. It is largely employed for lubricating purposes and in soap-making, and being when fresh and well refined of a clear yellow colour and pleasant taste, it is much used to adulterate olive oil. *Gingelly oil* is largely consumed in China and the East Indies as food, and the best qualities are equal, if not superior, to the best olive oil. In Europe the seed is principally crushed at Marseilles and Trieste.

Of the vegetable fats one of the chief is *cocoa-nut oil*. It is white, has a slight pleasant smell, and a rather agreeable taste. Its specific gravity is about 0.910; it melts at 122° Fahr., and of late years it has been largely used in soap and candle making. *Palm oil* is of the consistence of butter, and of an orange-yellow colour. It has an agreeable smell, and it melts at about 103° Fahr.

Volatile or Essential Oils.—These are an extensive and important class of bodies derived from the vegetable kingdom, and found in almost every part of the majority of the plants which produce them, except the cotyledons of the seeds, in which, in general, the fixed oils are exclusively stored up. Their presence confers upon flowers, leaves, fruit, seeds, roots, bark, and woods their peculiar and characteristic odours; but among these they are not equally distributed in the same individual, and are often altogether absent from some of them. To them we are indebted for our most delightful perfumes and our choicest spices and aromatics. Some of them are found to possess

valuable medicinal properties, and others are invested with the highest possible interest on account of their peculiar chemical constitution and the reactions which occur when they are brought into contact with other bodies. By exposure to the air volatile oils rapidly absorb oxygen, and become partially converted into resin. This is the cause of the deposit that usually forms in them when kept in an ill-corked vessel. The solid crystalline matter which separates from them when kept inclosed is stearoptene.

Chemically considered, the essential oils may be divided into three great classes:—1. Oils composed of carbon and hydrogen only, of which oil of turpentine may be regarded as the type. The oils of bergamot, capivi, cubeba, clemi, hops, juniper, lemon, orange peel, pepper, also belong to this class. 2. Oils containing carbon, hydrogen, and oxygen, including most of those in use in medicine and perfumery. To this class belong the oils of almonds, aniseed, cassia, cedar-wood, cinnamon, emmii, lavender, jasmine, meadow-sweet, orange-flowers, penny-royal, peppermint, spearmint, rosemary, rose-petals, valerian, winter grass, &c. 3. Oils containing sulphur, characterized by their extreme pungency, intense odour, vesicating power, property of blackening silver and being decomposed by contact with most other metallic bodies. The oils of asafetida, black mustard seed, garlic, horse-radish, and onions are of this kind.

Under the term of "mixed oils" are commonly included various mixtures of oils and other substances that possess an unctuous appearance. They are generally prepared by agitating the ingredients together, and after a sufficient time decanting the clear portion, which in some cases is then filtered. Some of them are highly esteemed as remedies, and the use of others is confined to veterinary medicine.

In some instances the volatile oils are obtained by pressure, without the application of heat: this is the case with the oils of lemons, oranges, and bergamot. In general, however, they are procurable only by distillation, and this is effected by putting the herb or bark into a still with water, when the oil and water are volatilized and condensed together.

The importance of the oil trade of the United Kingdom is indicated by the following statistics, showing the quantities and values of the oils and oil seeds imported during the years 1883–85:—

Oils and Oil Seeds.	1883.		1884.		1885.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
		£		£		£
Cocoa-nut oil, Cwts.	210,671	365,716	245,695	398,488	185,971	276,941
Olive " Tuns.	30,935	1,193,797	17,201	1,75,752	24,223	979,749
Palm " Cwts.	743,512	1,304,385	825,822	1,385,345	898,481	1,209,722
Seed " of all kinds, Tuns.	10,513	365,855	12,546	384,599	13,029	367,502
Train, Blubber, and Sperm oil, Tuns.	16,389	596,721	17,525	531,421	12,372	520,654
Turpentine, Cwts.	350,138	556,902	462,134	569,972	308,442	387,886
Cotton seed, Tons.	240,297	1,815,004	212,008	1,581,368	263,800	1,810,305
Flax and Linseed, Qrs.	2,387,867	4,815,730	1,805,535	3,832,242	2,056,268	4,407,112
Rape, Qrs.	775,358	1,609,562	769,813	1,603,669	544,275	883,681

Large quantities, both of oil and seed, are also produced in the United Kingdom for home consumption and export. Of these, together with the other oils reshipped to foreign countries, the quantity in 1885 was over 20,000,000 gallons, of the value of £2,400,000.

Hydrocarbon Oils.—These oils differ from the animal and vegetable oils previously described, in that they are composed of hydrogen and carbon only, and are in consequence not capable of true saponification in contact with the alkalis. They are for the most part obtained by the destructive distillation of organic matter, recent or fossil, though not a few exist preformed in the vegetable kingdom. In consistence they vary greatly. Some, such

as paraffin and naphthalene, are solid at ordinary temperatures; others, such as naphtha, oil of turpentine, and oil of lemon, are fluids of different degrees of density and volatility; while two bodies of quite similar constitution and properties—light and heavy carburetted hydrogen—are gaseous.

The number of these bodies is almost unlimited. Thus, from coal-tar we obtain the following series:—

Benzole, $C_{12}H_6$,	boiling at 186° Fahr.
Toluole, $C_{14}H_8$,	" 237° "
Xylole, $C_{16}H_{10}$,	" 288° "
Cumole, $C_{18}H_{12}$,	" 339° "
Cymole, $C_{20}H_{14}$,	" 390° "

Here it will be perceived that each member of the series contains $C_{12}H_{22}$ more than the preceding, and that each additional equivalent of carbon raises the boiling point 25.5 degrees.

From the bitumen of Trinidad, distilled at a low temperature, has been obtained a series of nineteen oils, whose equivalents range from $C_{14}H_{24}$ to $C_{22}H_{42}$, while the boiling point rises successively from 130° to 580° Fahr., and the specific gravity from 0.710 to 0.890.

A different series may thus be obtained from almost every variety of bitumen, coal, and resin, fossil or recent. In this group of bodies we find the phenomenon called *isomerism* strikingly illustrated. The oils, for example, of lemon and turpentine are exactly alike in composition, each consisting of $C_{10}H_{18}$, yet their properties differ considerably.

The uses of the hydrocarbon oils in the arts are numerous and highly important. Since they contain no oxygen, it is obvious that in combustion they must generate a greater amount of heat and light than the ordinary oxygenous oils. They cannot, however, be safely and advantageously burned without certain precautions. Being volatile, some of them at very low temperatures, and their vapour forming an explosive mixture with common air, care must be taken that the stock of oil in the cistern of the lamp does not get heated, and that the supply pipe leading to the burner be narrow. Unless the supply of oxygen is exceedingly abundant, these oils, from the large amount of carbon they contain, deposit much soot. The earliest lamps for burning camphine, a name given to rectified oil of turpentine, were jocularly said to yield "the light of six mould candles and the smoke of three kitchen chimneys." The coal-naphtha lamps, though giving a light little inferior to gas, were smoky, gave off an offensive odour, and occasioned some very serious accidents. By an improved construction of the lamps and careful rectification of the oils, the more volatile portions being rejected, the liquid hydrocarbons can now be burnt with cleanliness, economy, and safety.

As lubricants and antifriction pastes, certain of the hydrocarbons have been advantageously applied instead of the costlier oxygenous oils. As detergents for the removal of grease-spots from silks, &c., the oils of turpentine and lemon have long been used with success, but they are now superseded by benzole, or, as it is sometimes called, benzine. The hydrocarbons are, as we have already stated, incapable of saponification, but methods have been devised for mixing or incorporating benzole, turpentine, &c., with soaps. The advantages of these mixtures are, however, somewhat dubious.

Benzole and toluole are of great importance as being the materials from which aniline and toluidine, with their splendidly coloured derivatives, are prepared. For further information on this subject see BENZOLE, NAPHTHA, and NAPHTHALENE. By far the largest and most important of the hydrocarbon oils are—paraffin oil from shale, and petroleum oil from native petroleum. See PARAFFIN and PETROLEUM.

OINTMENTS, the name given to all soft, fatty substances applied to the skin by inunction. Formerly fragrant ointments were used by the ancient Egyptians, Jews, Greeks, and Romans for anointing the head and clothes on festive occasions. There are many allusions to this practice in the Old Testament, and it also appears that the Jews used perfumed ointments for funeral and ritual purposes. The use of ointments in medicine also dates from a remote period, and at the present day the term is commonly restricted to those preparations which are employed as remedies. When the active ingredients are pulverulent substances nothing can be more suitable to form the body of the ointment than sweet fresh lard clarified and freed from salt. The method usually employed to obtain the

latter conditions is to melt the lard in twice its weight of boiling water, stirring it constantly for some time, and then allowing it to cool. Where the drugs to be administered in this way are liquids, wax or prepared suet must be added to give due consistence to the compound. The simple ointment of the Pharmacopœia is made by melting together and stirring till cold three parts of clarified lard, three of almond oil, and two of white wax. Resinous ointment is prepared by adding to four parts of simple ointment two parts of powdered resin and one of yellow wax. Where ointments have to be kept for some time they may be prevented from becoming rancid by previously dissolving in the fat about 2 per cent. of gum-benzoin in fine powder, an addition which contributes also to the soothing effect of the application. Ointments form very useful applications to wounded, chafed, and abraded surfaces, and they are convenient vehicles for the introduction of many powerful remedies into the system through the pores of the skin. Where they are used for the latter purpose they must be slowly and carefully rubbed in until they disappear. The list of ointments included in the British Pharmacopœia is very extensive, and it may be taken for granted that the largely advertised nostrums of this kind contain no ingredient of importance of which the use is unknown to the medical profession.

OISE, a department in France, formed out of portions of Ile-de France and Picardy, is bounded N. by the department of Somme, E. by that of Aisne, S. by Seine-et-Marne and Seine-et-Oise, and W. by Eure and Seine-Inférieure. It is nearly of the form of a parallelogram, measuring about 60 miles from east to west and 40 from north to south. Its area is 2260 square miles, and the population in 1882 was 404,555.

General Character and Hydrography.—The department lies almost entirely in the basin of the Oise, which inclines to the south-west; a narrow zone along the northern boundary slopes towards the Somme; a broken hilly country, which forms the western part of Beauvais, and separates the valley of the Thérain from the Norman district of Bray, is drained by the Epte, a feeder of the Eure. A small portion of the south-east of the department is traversed by the Ourcq. The general surface presents extensive plains, with here and there masses of isolated hills, as seen along the left bank of the Oise; and another runs close along the northern boundary, forming part of the watershed between the basins of the Somme and the Seine.

The department is named from its chief river, the Oise (the ancient *Isara*), which rises in the forest of Thierache, near Chimay, in the Belgian province of Hainault, within 3 miles of the French frontier. Having entered France, its general course is south-west across the department of Aisne, wherein it becomes navigable at Chaunay; and continuing in the same direction across the department of Oise, in which it passes Noyon, Compiègne, and Creil, it enters Seine-et-Oise, and throws itself into the Seine at Conflans-Sainte-Honorine, a few miles below Pontoise. Its whole course is 137 miles in length, 75½ of which are navigable and form the important highway of the water communication to which the canals that unite the Somme, the Seine, and the Scheldt converge. The principal feeders of the Oise from the left bank are—the Ton, the Serre, the Lette, the Aisne, the Antonne, and the Nonette; from the right bank—the Noirieu, the Brèche, and the Thérain.

Soil, Climate, &c.—The soil of the plains is in general good, consisting of a strong calcareous clay, mixed in some places with flints and gravel. There is also a good deal of light sandy soil and some arid flats, which are either totally barren or covered with stunted underwood; the hills, on which the soil is thin and light, are in many parts overgrown with forest trees. There are extensive marshes in the valleys of the Oise and the Thérain. The department contains several forests, the largest being that of

Compiègne. The temperature is pretty equal all over the district; the climate is healthy, but rather damp; the winters are generally long and rainy; snow sometimes lies for a month in the north of the department.

Products and Animals.—Agriculture is in a very advanced state, and grain is extensively cultivated. The principal products are wheat and oats—with which the greatest breadth of land is sown—rye, barley, potatoes, &c. Other objects of culture are hemp, flax, chicory, onions, artichokes, turnips, carrots, and a vast quantity of various pot-herbs for the supply of the Paris markets. Rape and other oleaginous plants are grown. Some maize and beet-root are produced in the arrondissement of Senlis. The vine is cultivated in several districts of the south and east; but in general the summer heat has too little intensity and is of too short duration to give the proper degree of ripeness to the grape, so that the wine of the department is of inferior quality. Apples and prodigious quantities of black and red cherries are grown. The apple-trees are planted in rows along all the highways, and in the fields they are often set in quincunx order. Cider and beer are the common beverages of the country people.

The horses and horned cattle are of middling size. A great number of calves and fat cattle are supplied to the Paris markets; in the hilly country west of the valley of the Thérain cattle feeding is the common occupation of the people, and large quantities of cheese and butter are made. The ordinary breed of sheep is not good; but in some districts a cross with Spanish merinoes has produced an improved stock, with a good carcase and a heavy fine fleece. Poultry is abundant. The usual wild animals and game are common; the wolf, fox, and wild cat are seen but rarely. The wild swan, the crane, and the stork are among the birds of passage. The black eagle, a rare bird, inhabits the forests of Compiègne.

Industrial Resources.—The manufactures of the department are various; the principal being broadcloth, tapestry, carpets, blankets, and other woollen textures, for which Beauvais has been long famous. Linen, printed cottons, duck, lace, small wares, mirrors, carpets, spectacle glasses, toys, fancy cabinet-work and turnery, porcelain, pottery, beet-root sugar, paper, beer, ropes, tiles, bricks, leather, &c., are among the other industrial products. The various agricultural and industrial products of the department find ready outlets by the Oise, the Oureq, and the canals connected with them. Iron is found in some places, but no mines are worked; building stone, mill-stone grit, paving granite, chalk, marl, potter's and porcelain earths, turf, and fossil marble are found. The department is divided into the four arrondissements of Beauvais, Clermont, Compiègne, and Senlis.

O'KA is the name of an important river of Central Russia, which rises 40 miles south-west of OKEN, and joins the Volga on the right, after a course of about 800 miles. Its basin is estimated to comprise 127,000 square miles of the richest part of the Russian dominions. Though rapid, it is navigable for almost its whole course; and at Tula it is connected with the Don by a canal.

OKEAN'OS (Lat. *Oceanus*), the god of Ocean in the Greek mythology. Ocean, however, bore a quite different sense among the ancients to that which we give it. With them it was the mighty river which surrounded the vast disc of the world, the land lying in the midst of this great flood. From beyond Ocean to the east the sun-chariot was driven over above the great world-disc during the day, descending beyond Ocean to the west in the evening, and returning beneath the world during the night. As the oldest Greeks knew but little of the great eastward seas, but were well acquainted with those beyond the pillars of Héraklès (Straits of Gibraltar), the term ocean, if used definitely and not mythologically, usually meant with them the Atlantic Ocean.

Okeanos, the god of this vast circumfluent salt-river, was the son of Ouranos and Gaia (heaven and earth), and by his sister and consort Têthys, was father of all river-gods and sea-nymphs. Okeanos and Têthus belonged to the Titans or primeval gods of Greece, but retained their sovereignty over Ocean under the succeeding race of Olympian deities, of whom Zeus was the chief; although the Olympian Poseidón then became the supreme water-god, and as such might appear to supersede Okeanos. To reconcile these discrepancies is beyond our power, nor is it of importance.

OK'EGHEM. See OCKEGHEM.

OKEN, LORENZ, a celebrated German naturalist, was born at the Swabian village of Bohlshach, 1st August, 1779. His real name was Ockenfuss, which in his first published work he contracted into that of Oken, by which he is best known. He studied medicine and the natural sciences at the universities of Würzburg and of Göttingen, becoming *privat-docent* at the latter. In 1802 he published his first work, entitled "Grundriss der Naturphilosophie," the earliest of his attempts to apply systematically to natural history and philosophy the principles suggested by Fichte and Schelling. In 1805 he issued his treatise, "Die Zeugung," in which he maintained the proposition that all organic beings originate from and consist of *vesicles* or *cells*; and the following year, with the assistance of Kieser, he published a further important contribution to the study of generation in a volume entitled "Beiträge zur Vergleichenden Zoologie, Anatomie, et Physiologie." His originality and ability had now attracted attention, and in 1807 he accepted an invitation to the University of Jena, where he was appointed extraordinary professor of medicine. There and in that year he delivered his inaugural lecture on the "Significance of the Skull Bones," which was immediately published with the title "Über die Bedeutung der Schädelknochen." In this lecture he developed his favourite theory that there is an analogy between the skull or parts of the skull and the vertebral column, and that "the skull is a second body." The poet Goethe in his "Morphologie," published in 1820, laid claim to the original conception of this idea; but his indebtedness to Oken has been clearly proved by Professor Owen. The latter philosopher has also corrected and worked out inductively the "*a priori* guess" of Oken, and has established the truth that "the head is not a virtual equivalent of the trunk, but is only a portion—i.e. certain modified segments—of the whole body." In 1812 Oken was appointed ordinary professor of natural history at Jena, and in 1816 he founded his celebrated journal, the *Isis*, devoted chiefly to science, but which also admitted comments on political matters. The latter having given offence to the court of Weimar, Oken was called upon either to resign his professorship or suppress the *Isis*. He chose the former alternative, sent in his resignation, transferred the publication of the *Isis* to Rudolstadt, and remained at Jena as a private teacher of science. In 1821 he broached in the *Isis* the idea of an annual gathering of German *scientists*, and it was carried out successfully at Leipzig in the following year. To Oken, therefore, may be indirectly ascribed the genesis of the annual scientific gatherings common on the Continent, as well as of the British Association for the Advancement of Science, which at the outset was avowedly organized after his model. In 1828 he accepted a professorship in the University of Munich; but in 1832, on the proposal of the government to remove him to a provincial university, he resigned. In 1833 he was appointed professor of natural history at the newly-established University of Zurich, where he continued to reside until 11th August, 1851, when, full of years and honours, he died. Among his other works the more important are his treatise, "Ueben das Universum als Fortsetzung des Sinnensystems" (1808); his "Erste Ideen zur Theorie des Lichts" (1809);

"*Lehrbuch der Naturphilosophie*" (1810-11; third edition, 1843; English translation, "Elements of Physico-philosophy," 1847); "*Lehrbuch der Naturgeschichte*" (1813-27) and his "Allgemeine Naturgeschichte für alle Stände" (1833-41).

Oken's system of nature, based upon a curious system of *a priori* philosophy, and his entirely new method of nomenclature, have found very small favour with other naturalists, and his brilliant guesses would have accomplished but little for the advancement of science apart from the subsequent experimental discoveries and observations of other workers.

"Oken's real claims to the support and gratitude of naturalists," says Professor Owen, "rest on his appreciation of the true relations of natural history to intellectual progress, of its superior teachings to the mere utilitarian applications of observed facts, of its intrinsic dignity as a science."

OKHOTSK', a commercial town, situated on the northern shores of a wide gulf of the Pacific Ocean, called the Sea of Okhotsk, which separates the peninsula of Kamtschatka from the continent of Asia. The town is built on a low hill on the right bank and about 3 miles from the mouth of the Ochota. It is a small place with only 800 inhabitants, though it formerly contained a population of 2000; but it has a considerable commerce in Russian and American furs. It was the principal station of the Russo-American Company, and the chief seat of the Russian trade with Kamtschatka and North-western America. The harbour, which is frozen up from September to June, is formed by the river Ochota, which has a bar at its mouth with only 9 feet of water.

OLACINÆ is an order of plants belonging to the POLYPETALÆ, and nearly allied to the HOLLY family ILLICINÆ. This order contains plants which are rather of botanical than of economical interest. "The stem of *Phytoecne* is very curious, being white and very porous, and discharging, when cut, a stream of limpid potable water" (Sir J. Hooker). The generic name is therefore very applicable, as it means *plant-fountain*. The species are climbing shrubs with small flowers, and are natives of Martaban. Another interesting plant is *Olax zeylanica*; it "has a fastid wood with a saline taste, and is employed in putrid fevers; its leaves are used in salad" (Lindley). This tree is found in large quantity in Ceylon. It is from this genus that the order receives its name.

The characteristics of the Olacineæ are the following:—The calyx is small; the petals or corolla-lobes are valvate in æstivation; the disc is cupulate or annular; the ovary is one-celled, or sometimes imperfectly three to five-celled, with the septa not reaching the apex. "The one-celled superior ovary is succeeded by a broadly two-winged coriaceous white fruit, with a narrow central longitudinal cell containing one pendulous seed with very minute embryo next the hilum in a dense granular albumen. Of the two collateral pendulous ovules one only is impregnated; it consists of a naked nucleus, the embryo-sac of which is exserted as a very slender long tube" (Sir J. Hooker). There are 170 species, trees or shrubs, erect, climbing, or twining, natives of tropical and subtropical regions of the whole globe. The Illicineæ differ from this order in having complete cells in the ovary; the Cornaceæ differ in their inferior ovary.

OLAF TRYGVESON (that is, Olaf the son of Trygve) was the greatest hero of early Norway. His reign, for he came to be king, lasted only from 995 to 1000 A.D., but it had far-reaching consequences. Olaf's father was one of the undertakings of Norway, and was assassinated by the fierce Gunhild, widow of Erik Bloodaxe, his mother having to flee for her life and hide in caves till the birth of her child, when she left Norway for Sweden and for Russia. Olaf, thus born, was sold for a slave, and his mother was

also sold; but eventually he became a great viking, living as a sort of pirate chief in the Norse settlements of the Hebrides and of Dublin, whence he often descended upon the rich towns of the English—a raid on London itself with 300 ships, in 994, being one of his exploits. We know this to be true from the English Chronicle itself. In one of his voyages he touched at the Scilly Islands, and there met for the first time a Christian. This was a hermit working out his salvation in those lonely islands. Olaf heard him, and was converted. Ethelred of England bought off Olaf and his comrade, King Swein, the Fork-beard, of Denmark (in long after years to be Ethelred's successor as King of England), with much money—£16,000 in silver, says the Chronicle; but what was more efficacious, the brave Bishop Alphege sought out the greater viking, confirmed him in the Christian faith, baptized him, and made him vow never to plunder in England more. Olaf retired quietly to Dublin, and conscientiously kept his vow. Here he heard of the terrible tyranny with which Hakon the Bad was afflicting Norway, a king who in his cruelty and lust comes nearest to our own King John. He determined to free his native land, and on his arrival in Norway he was joined by multitudes. Hakon fled for shelter to one of his innumerable mistresses, who hid him in a cellar beneath the pigsty. From this hiding place he heard Olaf proclaimed king, for it happened cunningly that this took place on a great stone close to the house. Olaf offered great price for Hakon's head, whereupon the slave who attended the king fell upon him, and coming out into the light with the gory head, which he had hacked from the body, claimed his reward. The indignant Norsemen slew the traitor, and hung his head beside Hakon's.

Olaf at once imposed his new faith upon Norway, he being the first Christian king there. He overthrew the temples and the images of the Norse gods, and once, when forcibly compelled to offer human sacrifice, he seized the eleven highest nobles in the assembly and proposed, grudgingly, to offer them up as a beginning; accepting, however, as an alternative that all should come to his own way of thinking. Not content with his great success in Norway, though his methods were, he sent Christian missionaries to Iceland, and in the year 1000 had news that the Thing or Parliament of that great colony formally accepted their king's religion—a result which he never quite succeeded in getting thoroughly accomplished in Norway itself.

All this time Olaf went in momentary danger of his life; he quite determined to root out heathendom, the fierce Norsemen defending their idols with rage. They insisted once upon the king's marriage with the daughter of a chief whom he had slain defending a temple of Thor, and this took place, his enemies pretending to be converted. But in the night of his wedding he woke to find his bride aiming at his heart with a dagger. Such were his perils. Nevertheless his heart never failed. He was the most renowned man of the whole race of Northmen, could throw two javelins in battle, one with either hand and with sure aim, was the best bowman, the strongest swimmer, the greatest leaper, the merriest and wittiest man of the time, and the handsomest withal. Under his rule Norway sprang by rapid bounds to the headship of the three Norse kingdoms. Allured by the splendour of the hero, the sister of the King of Denmark (Swein Forkbeard) escaped from an unwelcome alliance, and fled from her brother to Olaf, who married her. This and other jealousies, as well as marriage alliances, &c., drew together Sweden and Denmark against Olaf; and by means of a treacherous earl, whom they induced to sail with Olaf on a Baltic expedition, the two kings with the entire strength of their kingdoms were able to fall upon Olaf as he and his ships were struggling among the shallows into which the traitor had guided them, and to cut him off with a few ships from the rest of his fleet, which sailed on unsuspectingly,

hidden by a projecting headland. The fight is described with wonderful vividness in Snorro Sturleson's history, the whole method of Norse sea-fighting being for once minutely described, the shooting with the great bows, the javelin-throwing, the heaving of great stones, and the hand-to-hand encounters when the final rush was made. Olaf, with his gilt shield and his helmet inlaid with gold, a short red coat over his armour, was easily recognized. Hour after hour did the *Long Serpent* keep off her innumerable foes, till sunset drew near, and hardly more than Olaf and his chief bowman remained. An arrow struck the man's bow and it snapped. "What has gone?" cried Olaf. "Norway, O King!" replied the man. Olaf sprang overboard, and was nevermore seen—save in a dream by his namesake, Olaf the Thickset (St. Olaf), to whom he appeared in the hour of his darkest need, and cheered him on to the recovery of his lost kingdom; but for many long years the people in Norway believed he had won safety by diving beneath the Danish ships, and looked for him to return, the most splendid figure that they or their whole time had ever known or were destined to know. Among the victors was Jarl Erik, son of Hakon the Bad. Him did the two kings set over Norway as a sort of viceroy, and the land lapsed for the most part into heathendom again until St. Olaf came.

OLAF, ST., King of Norway, was born in 995, and after having greatly distinguished himself early in life by a series of piratical expeditions in the Baltic and on the coasts of Normandy and England, he was converted to Christianity and baptized at Rouen. Returning to Norway he succeeded in wresting the throne from the powerful jarls Eric and Svend, and at once set about the extermination of paganism, and the re-introduction of Christianity by means of the potent weapons, fire and sword. He married Astrid, the daughter of the Swedish king Olof Skötkonung, and formed an alliance with the son and successor of that ruler. Anund Jacob, by whose aid he ravaged the coast of Denmark during the absence of King Cnut. When Cnut returned he led an expedition to Norway, and the Norwegians, wearied with the tyranny of Olaf, deserted him and swore allegiance to the invader. Olaf fled to the court of his brother in law, Jaroslaw of Russia, who gave him a body of soldiers, at the head of whom he returned to Norway in 1030, and encountered Cnut at Stiklestad. In the battle Olaf was defeated and slain, and his body, which was left on the field, was buried by a peasant. At a later period, owing to the report of miracles being wrought at his grave, his body was removed to the Cathedral of Trondhjem and deposited in a tomb, which became the chief sanctuary and place of pilgrimage of the country. In 1164 this active member of the church militant was canonized and solemnly proclaimed patron saint of Norway. Since the Reformation his fame has suffered an eclipse, but in 1847, King Oscar I. of Sweden and Norway created an order in his honour.

O'LAND or OELAND, an island in the Baltic, belonging to Sweden, län Kalmar, from which it is separated by Kalmar Sound, 5 to 15 miles wide. It is 90 miles long, N.N.E. to S.S.W., and from 4 to 10 miles broad; chiefly composed of limestone of Lower Silurian age, low on the west, and hilly on the east shore. It is well wooded, and the soil is fertile, though thin. Cattle and sheep are extensively reared, and the island is noted for its breed of ponies, which are only 3 or 4 feet high. The inhabitants are chiefly occupied in fishing and agriculture. The only town is Borgholm. The area is 477 square miles, and the population is about 46,000.

OLA'US, MAGNUS, a native of Sweden, born in 1490, was an archdeacon in the Swedish church when the Reformation, supported by Gustavus Vasa, gained the ascendancy in Sweden. In consequence of this change Magnus Olafson retired to Rome, where he spent the rest of his life

in the enjoyment of a small pension from the popes. At Rome he wrote his work, "*Historia de Gentibus Septentrionalibus*," &c. (Rome, folio, 1555, and Basel, 1567.) The work is minute, and contains some curious information in regard to Scandinavian customs and folk-lore, but is uncritically written. Olafus died at Rome in 1558.

OLBERS, HENRICH WILHELM MATTHIAS, a distinguished German astronomer, was born 11th October, 1758, at Arbergen, near Bremen. He studied medicine at Göttingen, 1777–80, and in 1779 he devised a method of calculating cometary orbits, which made an epoch in the treatment of the subject, and is still extensively used by astronomers. He finally settled as a physician in Bremen in 1781, and practised actively for above forty years. During this period he continued to devote himself also to the study of astronomy, and his self-denying labours were rewarded with several important discoveries, which have associated his name for ever with the history of this science. Piazzi of Palermo, having in 1801 discovered the planet Ceres between the orbits of Mars and Jupiter, Dr. Olbers calculated its orbit approximately, and was the first to observe it on its reappearance. He discovered the minor planet Pallas in March, 1802, and when its orbit had been calculated, he was led to propound the bold hypothesis, that the minor planets represented the dispersed fragments of a large planet which had at one time revolved round the sun, but which, from some unknown cause, had been broken up. This theory appeared to be confirmed by the discovery of Juno in 1804, by Harding, and of Vesta by himself in 1807, but it is now discarded by astronomers. In 1815 he discovered a comet having a period of seventy-four years, which has been named after him, and in 1826 he published an interesting dissertation on the probability of a comet coming into collision with the earth.

Dr. Olbers was elected a fellow of the Royal Society of London in 1804, and a foreign associate of the Académie des Sciences at Paris in 1829. He died at Bremen, 2nd March, 1840.

OLD CATHOLICS (Ger. *Alt-katholiken*), the name adopted by a religious party which took its rise in Germany in 1870–71, after the promulgation of the dogma of papal infallibility, 18th July, 1870. The voting at the council assembled at Rome, when the proposed new dogma was first carried, showed eighty-eight dissentients, while ninety-one of the members abstained from voting altogether; but after its final promulgation the whole of the dissentient bishops submitted and gave in their assent to the dogma. Each bishop in his turn demanded the same submission from the clergy of his diocese, under penalty of suspension from pastoral functions, to be followed by deprivation of office; but in Germany many of the Catholic professors publicly avowed their dissent, and published formal protests against the new doctrine. A meeting of Catholic professors and scholars, held at Nuremberg, August, 1870, resulted in the issue of a manifesto, in which its members declared that as students of ecclesiastical history it was impossible for them to accept the new decrees, and further, that they would not consent to profess with their lips that which they could not believe in their hearts. Early in 1871 M. Hyacinthe Loyson, an eloquent French preacher, better known as Father Hyacinthe, published a protest against the decrees, and in the March of the same year Dr. Dollinger, the learned ecclesiastical historian, published a letter, in which he asserted that as "a Christian, a theologian, an historical student, and a citizen, he was compelled to withhold his assent." In April, 1871, Dr. Dollinger and Professors Reinkens and Friedrich were excommunicated; but in the September of that year a congress of the dissentients, who now took the name of Old Catholics, was held at Munich, which was attended by nearly 500 delegates from almost all parts of the world, to protest against the decrees and the action of the Pope in

enforcing them. The proceedings were presided over by Professor von Schulte, and among those who took part in the deliberations were Döllinger, Reinkens, Maassen, Friedrich, and Huber. In the following year the movement made considerable progress, and at the congress held at Cologne in September, some 500 delegates and visitors were present, including the Anglican bishops of Ely and Lincoln, Dean Stauley, and other distinguished members of the English Church. In 1873, Prince Bismarck having entered upon his famous contest with the Vatican, the celebrated Falk Laws were enacted, by which the state claimed the supervision of the education of the clergy, and even their appointment and dismissal; the Prussian government, therefore, seeking allies, gave open encouragement to the new movement. On 11th August, 1873, Dr. Reinkens was consecrated Old Catholic Bishop of the German Empire by the Jansenist bishop Heykamp of Deventer, and his election being subsequently recognized by the Prussian government, he took, on the 7th of October, the oath of allegiance to the king. The new movement continued to make progress during the next two or three years, and it was decided by the leaders at their various conferences to discard the authority of the Council of Trent, to accept certain modifications of doctrine in reference to the Immaculate Conception, the number of the sacraments, indulgences, prayers for the dead, the eucharist, &c.; to abolish compulsory confession and fasting; to employ the vernacular in public worship; and to recognize the marriage of priests as lawful. The progress of the first few years in the number of adherents, however, received a check, owing to certain internal dissensions which afterwards arose, and in Germany a change of policy on the part of the government led to a withdrawal of the moral and material support at first awarded. The number of congregations professing Old Catholicism has in consequence declined since 1876, and unless some fresh vigour is instilled into the movement it appears destined to speedy extinction. From the first it was observed that while it gained the support of many eminent scholars and thinkers, it was chiefly an academic movement, and it awoke very little response from the mass of the Roman Catholics either in France or Germany.

For an account of the main facts connected with the history of the movement, see Dr. F. Nippold's "Handbuch der neuesten Kirchengeschichte" (vol. ii., 1883).

OLD RED SANDSTONE, a series of red sandstones, flagstones, and conglomerates lying beneath the carboniferous formations, and so named, in the early days of geological inquiry, in contradistinction to the very similar deposits above the coal measures, which then became known as the **NEW RED SANDSTONE**. The prevailing colour of these rocks is owing to the fact that each sandy particle is surrounded by a thin film of the red peroxide of iron, and this mineral constitutes the chief cementing material in most of the beds. Unfortunately the ferruginous admixture never occurs in sufficiently large quantities to be worked as an iron ore, and its presence is inimical to the preservation of fossil remains; only those strata that are comparatively free from it yield fossils in any abundance.

In the areas where they are developed these rocks occupy the same stratigraphical position as the great **DEVONIAN** series of marine formations—i.e. between the Silurian and Carboniferous; and they appear to be the lacustrine equivalents, at least, of this system, if not also of some portions of the marine beds of the Silurian and Carboniferous limestone. By Sir Roderick Murchison they were originally divided into three groups—an upper, middle, and lower—to correspond more or less with the accepted classification of the marine strata of Devonshire; but in no district are the three subdivisions found associated, and the classification was based altogether on the evidence of the contained fossil remains. More recent investigations, however, tend to show that there are only two well-marked

series, separated by an unconformity, and the following brief account of our present knowledge of the subject is mainly taken from Dr. Archibald Geikie's valuable memoir on the "Old Red Sandstone of Western Europe," read before the Royal Society of Edinburgh in 1879, and subsequently published in that society's *Transactions*. (See also Geikie's "Text-book of Geology," second edition, 1885.)

Dr. Geikie defines the two main subdivisions as follows:—

1. **Upper**.—Yellow and red sandstones, conglomerates, marls, &c., passing up conformably into the base of the Carboniferous system, and resting unconformably on the Lower Old Red Sandstone and every older formation—*Holoptychius*, *Pterichthys major*, &c.

2. **Lower**.—Red sandstones, conglomerates, flagstones, and associated igneous rocks, passing in some places conformably down into Upper Silurian formations—*Dipterus*, *Coccosteus*, *Cephalaspis*, *Pterygotus*, &c.

The Upper Old Red Sandstone is remarkably unfossiliferous, but the light-coloured beds of Dura Den, in Fifeshire, have yielded a large number of characteristic fishes that must have been suddenly overwhelmed in shoals. These belong to the genera *Pterichthys*, *Holoptychius*, *Glyptopomus*, *Glyptolamius*, and *Phanorhynchus*. Conglomerates and breccias are especially well developed in certain districts, as the Lammernuir Hills, Cumberland, and Westmorland, and their appearance has suggested the idea that they may be the result of glacial action. In South Wales sandstones and conglomerates of this age form the Beacons of Brecon (2800 feet), which are the highest eminences in that area. In Ireland the beds probably belonging to the same division are not only found to contain the characteristic fossil fishes, but also remains of land plants (*Paleopteris*, *Sphenopteris*, &c.) and a fresh-water mussel (*Anodonta Jukesii*) very closely allied to the common existing *Anodon*.

The detached basins in which the Lower Old Red Sandstone was deposited are regarded as so distinctly recognizable even yet, that Dr. Geikie has proposed to term them lakes, and give each area a different name. The Welsh Lake is the most southern of these basins, and its ancient sediments now occupy a triangular district between Wenlock, St. Bride's Bay, and the Mendip Hills. These rocks attain their greatest thickness in Herefordshire, and gradually thin out in all directions from that centre. The lowermost beds are especially interesting as forming a complete passage between the Silurian strata below, with a marine fauna, and the undoubtedly lacustrine sediments above; they yield a number of fossil fishes, of which the species of *Pteraspis* and *Cephalaspis* are the most important, and also remains of Crustacea.

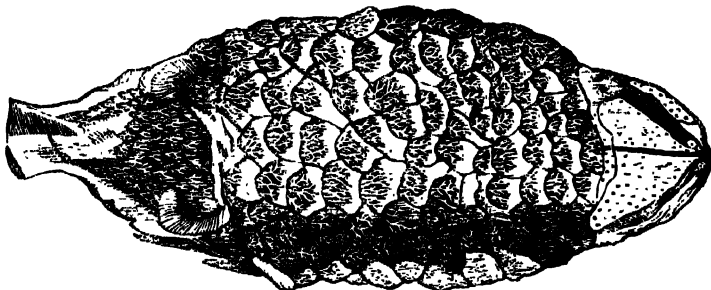
But the most typical development of the lower series in Britain occurs in Scotland, where Dr. Geikie has distinguished the deposits of Lakes Cheviot, Caledonia, Orcadie, and the Lake of Lorne. The first-named—Lake Cheviot—is a small area surrounding the present region of the Cheviot Hills. Lake Caledonia has left its sediments "in the central valley, between the base of the Highland mountains and the uplands of the southern counties. On the north-east it is cut off by the present coast-line from Stonehaven to the mouth of the Tay. On the south-west it ranges by the Island of Arran across St. George's Channel into Ireland, where it runs almost to the western sea-board, flanked on the north, as in Scotland, by hills of crystalline rocks, and on the south chiefly by a lower Silurian belt" (Geikie). Lake Orcadie is a more extensive basin to the north of the Highlands, only partially represented by the rocks at present exposed in that part of Scotland. "It may possibly have been at one time continued as far as the Soñnefjord and Dalsfjord, in Norway, where red conglomerates, like those of the north of Scotland, occur. There is even reason to infer that it may have ranged eastwards into Russia, for some of its characteristic

organisms are found also among the Devonian strata of that country" (Griekie). In this area are included the enormous deposits of flagstones that form so important an industry in Caithness. The Lake of Lorne was situated in the south-west Highlands—occupying the present district of Lorne, in Argyshire.

While these old lakes were thus being filled with sediment, volcanic eruptions were abundant immediately to the south of what is now the Grampian chain, and a few minor outbursts also occurred to the north. The volcanoes must have been of enormous dimensions, for their worn-down bases or "stumps" at present form several of the higher Scotch mountains—including even Ben Nevis itself; and the products of the eruptions—the lavas and ashes—attain to so great a thickness in certain regions, as to make up the larger portion of hill ranges such as the Ochils, the Sidlaws, and the Pentlands.

The fossil fishes of the Old Red Sandstone are of especial interest from the fact that—with the exception of a few imperfect remains from the Upper Silurian—they

graphic descriptions of these oddities in Hugh Miller's "Old Red Sandstone" have made them familiar to all readers of popular scientific literature. Pterichthys with its paddle-like flippers, is an extraordinary member of the

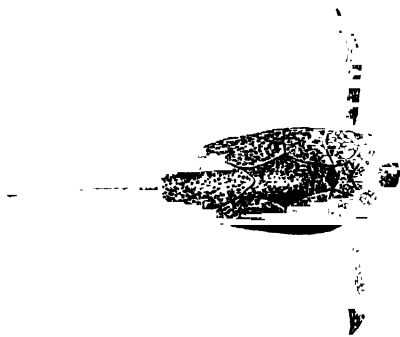


Holoptychius nobilissimus.

piscine community, and curious as it may seem when we remember the abundance of its remains that have already been unearthed, the positions of its eyes and its mouth are even yet a matter of dispute. *Coccosteus* is a close ally, but its orbits were distinctly lateral, it had a lower jaw, and its tail was destitute of a scaly armour. The buckler-headed fishes, *Cephalaspis* and *Pteraspis*, are likewise worthy of note: fine specimens of the first-named genus have been found in Forfarshire.

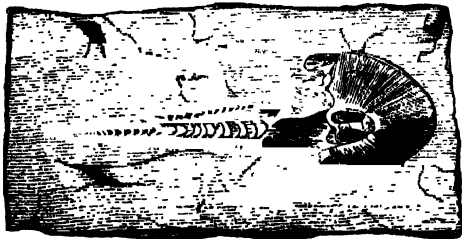
A tribe of little fishes with minute enamelled scales and a sharp spine in front of every fin (except the tail) was also well developed in the "Old Red" lakes, and a few survivors lingered on to the Permian period. These are the Acanthodians, and so far as can be ascertained they were intermediate in character between the sharks and the bony-plated fishes—not exactly one, not exactly the other. The more important genera are *Acanthodes*, *Diplocaanthus*, and *Cheiracanthus*. *Dipterus* is abundant in the flagstones of Caithness, and represents the "mud fishes," an order (or suborder) almost extinct at the present day, and only comprising the *Ptopterus* of Africa, the *Leptostreus* of South America, and the *Ceratodus* of Australia. The fringe-finned (*Crossopterygian*) suborder of ganoids, typified at present by the *Polypterus* of the Nile, has numerous interesting members among the Old Red Sandstone fossils. Most prominent perhaps is *Holoptychius*: this is a fine fish, so named in allusion to the wrinkles on the scales, and as it had a round body—somewhat flattened above and below—like most of its kindred its remains almost always exhibit either the ventral or dorsal, not the lateral, aspect; the figure in fact shows the ventral surface of a specimen in the British Museum. Other important *Crossopterygians* are *Diplopterus* and *Osteolepis*, each with smooth diamond-shaped scales. Huge crustaceans, chiefly of the genera *Pterygotus* and *Eurypterus*, and commonly found as fragments called "Seraphims," occur in the lowermost beds of the Old Red Sandstone in Lanarkshire, Forfarshire, and Perthshire, and in the passage beds to the Silurian on the borders of Wales. It ought also to be noted that a small bivalved crustacean (*Estheria norichisonia*) is abundant in certain horizons of the Caithness flagstones.

OLD CASTLE, SIR JOHN, the "good Lord Cobham," a gallant soldier and earnest reformer, was born in the reign of Edward III. He obtained the title of Lord Cobham with the hand of the heiress of the noble family of that name, and in her right sat in the House of Lords. Having read the writings of Wyclif, he became convinced of the need of a reformation in the church, and he zealously espoused the cause of the Lollards, by whom he was recognized as leader. A personal friend of Henry IV., his



Pterichthys oblongus.

constitute the earliest satisfactory evidence of vertebrate life upon the earth. The majority belong to the bony-plated ("ganoid") division of the class, and while some are referable to suborders even yet represented in the waters of the globe, others exhibit so peculiar a combina-



Cephalaspis.

tion of various features that their precise affinities are far from certain. Among the latter, *Pterichthys* and *Coccosteus* claim a foremost place: both are enveloped in front with hard bony plates, ornamented with tubercles, and the

reputation as a soldier and statesman stood so high that he was sent to assist the Duke of Burgundy in 1411 at the head of the English auxiliaries. He served with distinction in France, and was a companion-in-arms with the warlike Prince of Wales. Nevertheless the latter, on his accession to the throne in 1413 as Henry V., being anxious to gain the support of the clergy, sought to win their goodwill by a fierce persecution of the formidable Lollards. He endeavoured at the same time to protect his old friend, and tried hard to induce him to surrender his belief; but finding the sturdy old knight inflexible, he allowed the clergy to proceed against him. Sir John was accordingly excommunicated, arrested, and examined by Arundel, archbishop of Canterbury, and on his asserting his conviction that the clergy as a whole represented the Antichrist, he was committed to the Tower, forty days being allowed him in which to recant. He made his escape, and this event was the signal for a feeble and easily suppressed attempt at revolt on the part of the Lollards. Oldencastle escaped into Wales, where he remained in hiding for four years; but in 1417 he was arrested and taken to London. Being charged with heresy and rebellion, he was, on 25th December, 1417, suspended in chains from a gallows as a traitor, and a fire was kindled beneath him by which he was slowly burned to death as a heretic. He was the author of a work entitled "Twelve Conclusions Addressed to the Parliament of England."

A most extraordinary circumstance is connected with Sir John Oldencastle. Shakspeare found a character called John Olden in the old "Henry V." plays on which he founded his Henry IV., and this he expanded into the marvellous creation we know as Falstaff. The prince's address to "my old lad of the castle" has still, by a happy slip, been allowed to remain, preserving the original name in the pun. Sir John Olden had been a page to the Duke of Norfolk in Richard II.'s time, and this touch also Shakspeare availed himself of. But by so doing his Sir John Olden was manifestly identified with the "good Lord Cobham." The Catholics seized with avidity upon the poet's unconscious blunder, and identified the saintly Lollard with the cowardly fat knight. The Protestants and Oldencastle's family were bitterly wounded. The poet changed the name from Sir John Olden to Sir John Falstaff in his next edition; but this did not stop the scandal. Everyone loved and despised Falstaff, and the great popularity of the character therefore caused serious evils. At last in the epilogue to Henry IV. Shakspeare expressly stated that for him too "Oldencastle died a martyr, and this is not the man." But his troubles were not at an end; for the family of Sir John Fastolf, one of Henry V.'s captains, complained as loudly of the new name as the Cobham family of the old. But the poet was not wounding religious susceptibilities here, and refused to change further.

OLDENBURG, a grand-duchy in the north of Germany, bounded N. by the German Ocean, E. by Hanover and Bremen, and S. and W. by Hanover. The area is 2417 square miles. The population, according to the census of 1880, was 337,478. The duchy of Oldenburg Proper is a part of the great plain of Northern Germany, without mountains, hills, or forests. Heath and moors alternate with cultivated spots. The principal rivers are the Weser, the Jahde (the latter forming a large bay, where it falls into the German Ocean), the Hunte, the Hase, and the Leda. There are no large lakes. The principality of Lübeck is flat and resembles Oldenburg in its soil and climate, but it contains some beautiful lakes, especially those of Ploen and Eutin. The Schwartau and the Trave are the chief rivers. The principality of Birkenfeld lies on the side of the mountain range called the Hochwald, branches of which traverse it, and contain small valleys between them.

Corn, hemp, flax, rape, potatoes, pulse, hops, cheese,

butter, &c., are produced, and many horses, cattle, sheep, and pigs are reared. The most fertile districts are the But-Jahdinger-land, between the Jahde Bay on the north coast and the Weser, and that of Jever on the opposite side of the bay. Birkenfeld supplies iron, the only mineral of importance found in the duchy. Varel, on the south coast of Jahde Bay, is the chief industrial centre of the duchy, and has large cotton factories. Oldenburg is extremely well situated for commerce, but the trade is chiefly a coasting one. The chief articles exported to England, Holland, and Belgium are rape-seed, beans, oats, barley, wheat, and cattle—by far the greater proportion of all horned cattle annually shipped from the Weser ports to the United Kingdom being sent from Oldenburg.

A constitution was given to the grand-duchy, 18th February, 1819, which, "revised," in a conservative sense, by a decree of 22nd November, 1852, remains still in force. It grants liberty of the press, trial by jury, and equality of all citizens in political and social matters. The legislative power is exercised by a Landtag or Diet, elected for three years by the vote of all citizens paying taxes and not condemned for felony by a court of justice. The mode of election is indirect. Every 300 electors choose a delegate, and the delegates of thirty-three districts, representing 10,000 electors, appoint one deputy. No property qualification is required to become a member of the Diet. The budget must be granted by the Diet from year to year. The public revenue amounts to about £300,000 per annum, and the expenditure to about the same sum. The chief item of revenue is from customs, and next to it from the produce of state property. The debt amounts to £1,912,500.

The ancient house of Oldenburg, which has given sovereigns to Denmark, Scandinavia, and Russia, is said to be descended from Wittekind, the celebrated leader of the heathen Saxons against Charlemagne. In the fifteenth century a scion of the house of Oldenburg, Count Christian VIII., was elected king of Denmark, Sweden, and Norway. The main line became extinguished with Count Gunther in 1667, whereupon the territory of the family fell to the King of Denmark, who made it over to Grand-duke Paul of Russia in exchange for pretended claims upon Schleswig-Holstein. The grand-duke then gave Oldenburg to his cousin, Prince Frederick Augustus of Holstein-Gottorp, with whose descendants it remained till December, 1810, when Napoleon incorporated it with the kingdom of Westphalia. But the Congress of Vienna not only gave the country back to its former sovereign, but at the urgent demand of Czar Alexander I., added to it a territory of nearly 400 square miles with 50,000 inhabitants, bestowing at the same time upon the prince the title of grand-duke. Part of the new territory consisted of the principality of Birkenfeld, on the left bank of the Rhine, close to the French frontier, and some 300 miles distant from Oldenburg. In 1854 Grand-duke Peter sold a district of 3154 acres, on the North Sea, with the harbour of Jahde, destined for a naval port, to Prussia, for the sum of £74,800.

OLDENBURG, the capital of the above state, is a well-built town on the navigable river Hunte; the ramparts have been converted into public walks and gardens. The population is 19,000, and it has a gymnasium, military and normal schools, and a library of about 100,000 volumes. It is the residence of the grand-duke, and the palace is a very handsome building with a fine park. There are several public edifices and a few manufactories.

OLDHAM, a parliamentary and municipal borough, and flourishing manufacturing town of England, in the county of Lancashire, situated 19½ miles from London and 6 from Manchester, at the foot of the lofty hills leading into Yorkshire, from which a branch of the Medlock flows past the town. Its rapid rise is chiefly attributable

to its being in the immediate neighbourhood of extensive coal mines, which give employment to a large portion of the population, and also to the great increase of cotton manufactures. The manufactures of fustians, velvets, cords, cotton, woollen, and silk goods are very extensive. It possesses some of the largest mills in the kingdom, some of which are conducted on the co-operative principle, but the plan has not been found a perfect success. In order to find occupation for the unemployed operatives during the "cotton famine," in 1862-64, the corporations of many towns availed themselves of the Public Works Act, to execute sanitary measures that might otherwise have been deferred. The works of primary importance thus carried out at Oldham were the extension of the water supply and the formation of the Alexandra Park, on an area of 72 acres purchased by the corporation. Oldham has a Gothic parish church, district churches, and numerous Methodist, Independent, Unitarian, and Roman Catholic chapels; a Friends' meeting-house; town hall, enlarged in 1880, in the Grecian style, including assembly rooms, post office, &c.; public baths, working men's and temperance halls; several banks; public library or lyceum, a Gothic school of science and art, and several literary institutions. The educational establishments include Harshaw's Blue-coat School, founded in 1807 and opened in 1831, and Assheton's Free Grammar-school. There are a union and two public cemeteries containing 46 acres. Mill machinery is extensively constructed by Messrs. Platt Brothers & Co. at the Hartford Works, which are among the largest in the world. Oldham is divided into above-town and below-town, and is in the parish of Prestwich. It has excellent railway communication. It was created a borough by the Reform Act of 1832, and returns two members to the House of Commons. The municipal borough is divided into eight wards, and governed by a mayor, eight aldermen, and twenty-four councillors. The population of the parliamentary borough in 1881 was 152,513; of the municipal, 111,343.

OLDHAVEN BEDS, a thin series of sandy deposits occurring between the LONDON CLAY and the underlying WOOLWICH AND READING BEDS, and so named from their typical development round Oldhaven (or Bishopstone) Gap on the north coast of Kent. They contain fossils chiefly of a marine type, and are particularly remarkable on account of the abundance of waterworn flint pebbles everywhere conspicuous. The precise inferences to be drawn from the latter are still a matter of dispute, but the Oldhaven beds evidently testify to considerable changes in the currents and relative positions of marine and estuarine areas, and are regarded by the geological survey as separable from the London clay series, with which they were first classified by Professor Prestwich. [See Eocene.] The well-known pebble beds of Blackheath, near London, and Addington, near Croydon, are of this age.

OLEACEÆ is an order of plants belonging to the GAMOPHYTES, cohort Geraniales. The species best known in this country are—the OLIVE, or *Olea europæa*; the LILAC, or *Syringa vulgaris*; the Evergreen Phillyrea, of many forms; the Privet, or *Ligustrum*; the Ash, or *Fraxinus*; and the Fringe Tree, or *Chionanthus*. They all correspond in habit and in sensible properties, which latter are very generally bitter and febrifugal. In this order the corolla-lobes are four, five, or several; there are two stamens (rarely four), alternate with the carpels; the style is simple, with a terminal stigma; the ovary is superior, two-celled, with two ovules in each cell attached to the septum. The name of the order is derived from the typical genus *Olea*.

OLEANDER (*Nerium*) is a genus of plants belonging to the APOCYNACEÆ. The species are shrubs with opposite or whorled thick leaves. The flowers are large and showy, in terminal clusters. The corolla is salver-shaped, with a corona of five-toothed scales. There are five stamens; the

anthers have a long, hairy, twisted appendage at their apex. There are two ovaries, which are changed in the fruit into two long cylindrical pods with numerous tufted seeds. There are about eight species, most of them natives of India. The Common Oleander (*Nerium Oleander*) has become naturalized in the south of Europe, and is a very favourite plant in the streets of many continental towns. The flowers are very showy, and last a long time; they are generally of a rose colour, but there are white, purple, and variegated varieties. The whole plant is very poisonous.

O'LEFIANT GAS. See HYDROGEN.

O'LEIC ACID is a fatty acid found in olive, almond, and other fixed oils combined with glycerin. It is obtained on the large scale from the lime soap produced in the saponification of tallow by treating it with sulphuric acid, on pressing the resulting fatty acids, which consist of stearic and oleic acids; the latter is separated as a fluid. It is also largely manufactured by acting on palm-oil with superheated steam, and separating the resulting mixture of crystalline palmitic acid and the liquid oleic acid by pressure and filtration. Below 14° C. (57° Fahr.) it may be crystallized from alcohol, in which it is very soluble, as it is also in ether, but not in water. It dissolves in oil of vitriol without decomposition. The formula is $C_{18}H_{34}O_2$. It is much used in the manufacture of hard and soft soaps; the former is mostly oleate of soda, and the latter oleate of potash. The general formula of the oleates is $C_{18}H_{33}NO_2$. The oleates of bismuth, copper, lead, mercury, and zinc are all employed in medicine for external application. The common lead plaster is crude oleate of lead. Oleates of some of the alkaloids, as morphia and quinine, are used internally.

O'LEIC ETHER, or Oleate of Ethyl ($C_{20}H_{40}O_2$), is a colourless liquid, soluble in alcohol, and having a specific gravity of 0.870. It decomposes on boiling.

O'LEIN. This substance forms a constituent of nearly all fixed fats and expressed oils. It is an oleate of glyceryl ($C_{21}H_{40}O_4$), and is a neutral fluid oil, the properties differing according to the source from which it is derived. When pure it is colourless, insoluble in water, very soluble in ether and alcohol. It has a specific gravity of 0.920, and burns with a luminous flame. When saponified with potash it yields oleate of potassium and glycerin. On account of the low temperature at which olein congeals, it is employed for lubricating the delicate wheels of watches.

O'LEO-MAR-GARINE is the name given to a preparation of animal fat used as a substitute for butter. In its manufacture fresh beef fat from recently killed cattle is melted at a low temperature, and the oil thus obtained, after being kept from thirty to thirty-six hours at a temperature of 85° Fahr., is submitted to hydraulic pressure, by which it is separated into stearin and oleo-margarine. The latter is afterwards churned up with milk, a little annatto being added to give it a yellow colour, and run upon pounded ice to cause it to solidify. It is afterwards churned again with fresh milk, kneaded, salted, and sent out into the market. Under the name of *butterine* large quantities of this preparation are annually imported into England.

OLÉRON, ISLE OF, the ancient *Utiarus*, is an island in the Bay of Biscay, off the west coast of France, in the department of Charente-Inférieure, separated at its south end from the shore by a strait (the dangerous Pertuis de Maumusson) a mile wide. Its length, N.N.W. to S.S.E., is 17 miles, and breadth 7 miles. The soil is mostly fertile, and the island is important from its large production of wine and salt. The population is 19,000. The island is traditionally connected with the naval ordinances known as the Laws of Oléron. See next article.

OLÉRON, LAWS OF. The laws, or constitutions, or judgments of Oléron are a capitulary of ancient marine customs written in Old French, and bearing the name of

Oléron for several centuries, because tradition points to the island so called in the department of Charente-Inférieure as the place of their original promulgation. An ancient copy of these laws is to be found in the "Black Book" of the Admiralty, the original of which is supposed to be in the Bodleian Library; but they are not there called the Laws of Oléron, nor is there any reference in the laws themselves, nor in the book which contains them, to their origin or history. They are generally referred to by French writers on maritime law as "Jugements d'Oléron." They relate to the rights and duties of shipowners, mariners, maritime contracts, pilotage, port and custom laws, and losses at sea; but are chiefly remarkable at the present day from the circumstance that they were for several centuries adopted by all the nations of Europe as the foundation of their maritime laws. There is no ground for the statement that these laws were made by Richard I. of England at Oléron on his return from the Holy Land, and there are strong reasons for assigning them to a later date.

OLFACTORY NERVE. See NOSE.

OLIBANUM is a gum-resin derived from species of *BOSWELLIA*. It has been used from very ancient times as incense, and its use in this way is described under the heading FRANKINCENSE. As a medicine, it is hardly ever used in this country at the present day, but was formerly recognized in the London and Edinburgh Pharmacopœias as stimulant, diuretic, and diaphoretic, its action being especially effective on the mucous membrane of the lungs. In the Pharmacopœia of India it is recommended for bronchitis and pulmonary affections, either taken internally or in the form of a fumigation. It is also employed as a stimulant for loils, &c.

OLIGARCHY is arbitrary government by a faction. It is often a branch of *aristocracy*, government by a noble class, as in the hereditary noble oligarchy of Venice; but is not necessarily so, as witness the "Thirty Tyrants" of ancient Athens, &c. It is usually considered, and with reason, to be the worst form of government, nearly always resting upon the mere power of money and self-interest.

OLIGOCENE, a term first proposed by Beyrich, and employed chiefly by continental geologists to denote the series of early tertiary deposits from the base of the Upper Eocene to the top of the Lower Miocene. According to Mr. Etheridge (in Phillips' "Manual of Geology," new edition, vol. ii., 1885), this division appears to be represented in England by the strata in the Hampshire basin, from the Heaton to the Hempstead beds inclusive. The group is equivalent to the *Postnummulitic* of table in article GEOLOGY.

OLIGOCHÆTA is an order of Chætopod worms, of which the Common EARTHWORM (*Lumbricus terrestris*) is an example. The order is distinguished by the reduction of the lateral appendages, short bristles inserted in the skin taking the place of the elaborate parapodia of the Polychæta. The Oligochæta are found in mud, earth, and fresh waters. Some, as Chætogaster, reproduce by gemmation. Hermaphroditism is usual.

OLIGOCLASE (Gr. *oligos*, little, *klaō*, to cleave) is a variety of FELSPAR belonging to the obliquely-cleaved (plagioclase) group. It is often regarded as an isomorphous mixture of albite and anorthite, from two to four molecules of the former combining with one molecule of the latter.

OLIVEREZ, GASPAR GUZMAN, COUNT OF, Duke of St. Lucar de Barrameda, a celebrated Spanish statesman, was born at Rome about 1687, where his father was ambassador from Philip III., and educated at Salamanca. When Philip IV., at the age of seventeen, ascended the throne in 1621, Olivarez had so much ingratiated himself with the king that he was created a duke and intrusted with the affairs of the kingdom. He speedily assumed uncontrolled power, and surrounded himself with worthless

favourites, who were mere instruments in his hands. Although his system of government was unjust and arbitrary, a great many public abuses were checked during his administration. But nothing was done to promote the internal prosperity of the country, which was crippled by the heavy taxation imposed to support the foreign wars, and the discontent excited by distress at home was increased by the constant failure of the minister's schemes abroad; for, through the influence of Cardinal Richelieu, Olivarez was baffled in every attempt to regain the influence which Spain had once exercised all over Europe.

His unpopularity had become general when the insurrection of Catalonia, and soon after that of Portugal, took place, in 1640, in consequence of the minister's attempts to invade the rights of those states. These events, and more particularly his attempts to trample on the privileges of a proud nobility, were a deathblow to his power. In 1613 he was requested by the king to resign, and, detested by the whole nation, he died at Toro, where he had retired, in 1615.

OLIVE (*Olea europæa*) is a name given to the tree, and also to the fruit, which affords the well-known oil. It is a native originally of Syria and Asia Minor, where it forms forests; but it has now become naturalized in a vast tract extending east and west from the Canaries to the Punjab, and north and south from the south of France to the Atlas Mountains. (See A. De Candolle, "The Origin of Cultivated Plants," 1885.) "The olive is one of the most characteristic and beautiful features of all southern scenery. On the slopes of the Northern Apennines olives are the usual forest timber; the whole of the Val d'Arno is wooded with them, every one of its gardens is filled with them, and they grow in orchard like tanks out of its fields of maize, or corn, or vine, so that it is physically impossible in most parts of the neighbourhood of Florence, Pistoya, Lucca, or Pisa, to choose any site of landscape which shall not owe its leading character to the foliage of these trees. What the elm and oak are to England, the olive is to Italy. . . . The main characteristics of an olive-tree are these:—It has sharp and slender leaves of a grayish-green, nearly gray on the under surface, and resembling, but somewhat smaller than, those of our common willow. Its fruit, when ripe, is black and lustrous; but, of course, so small that, unless in great quantity, it is not conspicuous upon the tree. Its trunk and branches are peculiarly fantastic in their twisting, showing their fibres at every turn; and the trunk is often hollow and even rent into many divisions like separated stems, but the extremities are exquisitely graceful, especially in the setting on of the leaves; and the notable and characteristic effect of the tree in the distance is of a rounded and soft mass or ball of downy foliage." (Ruskin, "Stones of Venice.") It differs from most trees, except the Sweet Bay (*Laurus nobilis*), some species of Cornus, and a very few others, in yielding a fixed oil from the pericarp. The oil which is expressed from the ripe fruit immediately after being collected is most esteemed, and called virgin oil. That which is most highly prized comes from Nice and Genoa. It is the lightest of the fixed oils, its density being only .910, and is largely used in the south of Europe as an article of diet, and in the north of Europe for salads and in cookery. When the oil is extracted by a stronger pressure, or by the aid of heat, or after the olives, having been collected into heaps, have remained till a kind of fermentation has occurred, it is the common olive oil, the properties of which vary in proportion as the fermentation has been of long or short duration. An oil of still inferior quality is obtained when the husk of the olive, after the former treatment, is boiled in water. This kind is employed solely for the manufacture of soap. The imports and exports of olive oil are given in the article OILS. The genus *Olea* is the type of the order

OLEACEÆ; its leaves are evergreen, and the minute white flowers are arranged in small clusters (fig. 1). The ovary is two-celled (fig. 2), with two ovules, ripening into a fleshy drupe (fig. 3) with a stone which is two-celled, but sometimes has only a single cell with one seed.

The olive-tree was, in the Greek religion, sacred to the goddess Athena, who caused it to spring from the ground of the Acropolis at Athens, in the famous contest for rights of patronage over the city which she held with Poseidon. [See ATHENA.] It was from leaves of the sacred olive of

domestically an olive crown was used :

vestibule of a Greek house to announce the birth of a man-child, a girl-child's birth being announced by a crown of plaited wool. This custom was followed by the Latins also.



Olive.

In Christian times the olive served as the symbol of peace, as it was an olive branch with which the dove returned to Noah, thereby assuring him that the great storm had ceased, that the deluge was abating, and that peace would return upon the earth.

OL'IVENTE, a copper ore of an olive-green colour, consisting of oxide of copper, 63·00; phosphoric acid, 26·6; water, 8·4. It occurs in micaceous clay slate.

OLIVE-SHELL (*Oliva*) is a genus of Gasteropoda, nearly allied to the *HARP-SHELLS* (*Harpa*). The shell is cylindrical and polished, with the spire very short and the suture deeply channelled. The aperture is long, narrow, and notched in front. The foot is very large, inclosing part of the shell. The mantle-lobes are large, and meet over the back of the shell, giving off filaments which are lodged in the suture. The olives are active and carnivorous animals, ranging from low-water to 25 fathoms; 120 species, all subtropical, have been described. The shells of some of the species are much sought after by collectors.

OLIVET, or **MOUNT OF OLIVES**, a famous hill east of Jerusalem, and rising about 200 feet above it; 2648 feet above the sea, and 3940 feet above the level of the Dead Sea. It has three summits, the highest of which is traditionally the scene of our Lord's Ascension, and is crowned by a commemorative church.

OL'IVINE, **CHRY'SOLITE**, or **PER'IDOTE** is a yellowish or olive-green mineral, usually transparent or translucent, and consisting of anhydrous silicate of magnesia and iron. It occurs in eruptive rocks, such as basalts and gabbros, and sometimes forms the main constituent of other crystalline intrusive masses (peridotites, &c.); volcanic bombs are also not unfrequently made up

of crystalline grains of this mineral, and fine examples are especially abundant in the tuffs of the Eifel district in Germany. The olivine rocks are of peculiar interest on account of their common alteration into **SERPENTINE**; olivine, indeed, is readily decomposed by the action of percolating water, which penetrates into its numerous radiating cracks, and the last named ornamental rock is the product of the change. The lighter and harder varieties are more properly termed *chrysolite*, and when pebbles free from cracks or flaws are met with, they are commonly cut and polished as inferior gems. *Chrysolite* appears to have been often referred to as topaz by the ancients, but it is readily distinguished by its greater softness. Pebbles, more or less water-worn, are obtained from Auvergne in France, Upper Egypt, the Isle of Bourbon, Mexico, and several other localities.

OL'LA PODR'IDA (Spanish, putrid pot), the name of a favourite dish in the *cuisine* of Spain, consisting of a mixture of all kinds of meat, cut into small pieces, and stewed with different vegetables. The epithet *podrida* has been attached to this dish because the poor are often compelled to keep it on their table until it exhales an odour anything but agreeable. The term corresponds to our *hodge-podge*, and to the French *pot-pourri*, all three being frequently employed in a figurative sense.

OL'MUTZ, a strongly fortified city of the Austrian Empire, in the province of Moravia, the capital of a circle, is situated on the March, which almost surrounds it, on the railway from Breslau to Vienna, 100 miles N.N.E. of the latter city, 650 feet above the sea. It is well built, has a fine Gothic cathedral and other churches, university, founded in 1581, and a library of 50,000 volumes; town-

hall, archbishop's palace, convents, theatre, arsenal, barracks, &c. It has a college and other schools, and manufactures of linens, woollens, iron goods, and wire, besides an important cattle market. It has been often besieged, and was for several years the prison of Lafayette. The population, exclusive of the garrison of 6000 men, numbers about 16,000.

OLNEY, a town of England, in the county of Bucks, situated on the north bank of the Ouse, 52 miles N. N. W. from London on the Midland Railway. The town consists of one long and very wide street. The church has a spire 185 feet high, and is visible from a long distance. There are places of worship for Baptists and Independents, and almshouses for twelve females. The population of the parish in 1881 was 2430. Lacemaking was long the chief employment of the inhabitants, but it is now carried on only to a very limited extent. There is a large tanyard, and that and shoemaking for the Northampton manufacturers employ nearly the whole of the male population. There is also a good trade in malting. Olney is historically famous as having been for many years the residence of the poet Cowper. His house and "oak" are still in good preservation and objects of great attraction. The living has been held by some rather eminent men—including Moses Brown, Scott, the commentator on the Bible, and Cowper's friend Newton.

OLONETZ, a town of Russia, formerly capital of a government of the same name, is situated on the river Olonka. It is an open town, with 2700 inhabitants. There are three stone and five wooden churches. Shipbuilding is carried on.

OLUMPUS (Lat. *Olympus*), a renowned musician of ancient Greece, a Phrygian by birth, living about B.C. 650. He brought the flute from Phrygia into Greece, and with it a peculiar scale of five notes called the *enharmonic* scale. Olumpus' scale ran thus:—

b, c e, f a

two strings of the lyre being thus left unused. These two he tuned to small intervals or quarter tones, the *d* string being lowered to *c*, and the *e* half-way to *b*, where the comma is placed in the illustration; so also the *g* string was lowered to *f*, and the *f* string nearly to *e*, in the place of the second comma. The quarter tones were merely grace notes. Like most Greek scales [see GREEK MUSICAL SYSTEM] this of Olumpus is divisible into two exactly similar tetrachords, which in his case overlap, thus:—

b c - e
c f - a

From this ancient enharmonic tetrachord was derived the *chromatic* tetrachord by adding the minor third below the top note (as for example *c* in the first of the two) so as to get in this case *b c c# e*; and also the *diatonic* tetrachord *b* substituting for this the minor third above the lowest note (i.e. *d* in the first of the two tetrachords), giving *b c d e*.

OLYMPIAD (Gr. *olimpias*), the name given to the period of four years that elapsed between each celebration of the Olympic games. The first year of the first Olympiad began 776 years and six months before our era; and from the winner in the foot-race on that occasion, is frequently called the Olympiad of Koribos. The first year of the Christian era corresponded to the last half of the fourth year of the 194th and the first half of the first year of the 195th Olympiad. Computation by Olympiads terminated with the second year of the 293rd Olympiad, or A.D. 394, when Theodosius, emperor of the East, abolished the games. See **OLYMPIC GAMES**.

To convert *Olympiads* into *Christian time*: Multiply the number of the past complete Olympiads by 4, and add the odd years; subtract the sum from 777, if before Christ, or from 776, if after Christ; the remainder will give the

year before or after Christ, if the event happened between July and January (the first six months of the Olympian year); but if it occurred between January and July, the remainder must be diminished by one. For example: the foundation of Rome took place in the tenth month of the third year of the sixth Olympiad ($5 \times 4 + 3 = 23$.) From 777 take 23 = 754, which, diminished by 1, gives 753 B.C. The month corresponds to April.

OLYMPIC GAMES, the chief of the four great national festivals of the Greeks, were celebrated at Olympia, a small plain on the banks of the Alpheus, near Elis, crowded with temples and sacred buildings, every fourth year. The exact interval at which it recurred was one of forty-nine and fifty lunar months alternately; so that it fell sometimes in the month of Apollonios (July), sometimes in the month of Parthenios (August). The period between two celebrations was called an Olympiad. The festival began with the first full moon after the summer solstice, and lasted five days. The origin of it is unknown. There was a tradition that the festival was revived by Iphitos, king of the Eleans, 881 B.C. Olympiads began to be reckoned from the year 776 B.C., in which Koribos was victor in the foot-race. We have lists of the victors from that year, which always include the victors in the foot-race, and in later times those in the other games. The olive crown, to become so famous, was first given in 752.

This, like all the other public festivals, might be attended by all who were of the Hellenic race, though at first probably the northern Greeks and perhaps the Achaean of Peloponnesos were not admitted. Spectators came to Olympia not only from Greece itself, but also from the Grecian colonies in Europe, Asia, and Africa. Among them were solemn deputations sent to represent their respective states. No women were allowed to be present, or even to cross the river Alpheus during the games, under pain of death. The Olympian festival consisted of religious ceremonies, athletic contests, races, and exercises in music and poetry. Twenty-four various contests in all are numbered, six of which were limited to boys; but many of these only lasted for a few festivals and were then discontinued. The presiding deity was Zeus Olympios, whose temple at Olympia contained the chryselephantine statue of the god by Pheidias. During the celebration of the festival the territory of Elis was held inviolable, and the invasion of it was sacrilege. The victor was received by his native city in triumphal procession, and was always awarded many privileges. A victory at Olympia was as much thought of as a victory in the battle-field. This festival formed a kind of bond of union among the Grecian states, which were so much distracted by contending interests and rivalries, and its effect permeates the entire history of Greece.

OLYMPUS, MOUNT (Gr. *Olimpos*), the mountain range east of Pindus, especially that which skirts the coast along Pieria, and ends in a conical mass about 9700 feet high, forming the north wall of the Vale of Tempe, and the boundary between Thessaly and Macedonia in ancient times. The summit of this mass is broken into many peaks, and is covered with perpetual snow. It was chosen by the early poets as the home of the later gods led by Zeus, who displaced the Titans led by Chronos, as these had displaced the primeval gods of nature led by Ouranos. On the top of Olympus, beyond the clouds and hidden from mortal eyes, Zeus and his companions lived in splendid palaces, inaccessible to all but themselves. The Titans piled Pelion on Ossa in the great fight, but even then could not scale Olympus. Later poets tried to make the term symbolical, and spoke of Olympus as we now speak of heaven, but the terms are too precise in Homer to admit of the slightest doubt as to the exact locality intended and the genuine good faith in the material homes of the gods upon this Thessalian mountain-top.

OM or **AUM**, a Sanskrit word possessing the highest sanctity in both the Hindu and Buddhist systems of religion. In the earliest of the Vedas it appears as a term of solemn assent used both by the gods and their worshippers to imply "so be it" or "so it is," but in the later writings of Hinduism it becomes invested with a variety of significations. In some of the religious ceremonies described in the Rîg-Veda it is used as a response to the recitation of the sacred verses, and it became customary to pronounce it in a solemn manner at the beginning and the end of every study of the canonical scriptures. The etymology of the word seems to have been lost at an early period, a circumstance which opened the way for much ingenious speculation on the part of the Hindu theologians in their attempts to explain its mystical meaning. Thus in the institutes of Manu it is asserted, "All rites ordained in the Veda, such as burnt and other sacrifices, pass away; but the syllable *Om* must be considered as indestructible, for it is (or represents) Brahma himself, the Lord of Creation." Still later each of the three letters *a, u, m*, became symbols of an ineffable mystery, and ultimately it came in Brahmanism to represent the names of the three gods, Brahma, Vishnu, and Siva, who form the Hindu trinity. Like the Hebrew *Jah* it was invested with peculiar sanctity, and at the present day the Brahmans esteem it so holy that they will not utter it aloud, while the Jains, laying the hand upon the mouth, whisper it in the deepest reverence.

As we have noticed under **BUDDHISM**, the latter system was introduced in the form of a revolt against the prevailing system of Brahmanism, which for a time it very nearly superseded. But after the two systems had coexisted side by side for a long period Brahmanism recovered most of its former influence in India, Buddhism receding before it. During this prolonged struggle each system must have exerted a modifying influence upon the other, and among the evidences of this it is interesting to note that the sacred word of the Brahmans, invested with entirely different significations, has become a term of the highest importance in the worship of the Buddhists. In the earliest stages of Buddhism it is not found either in the sacred writings or engraved upon the temples, but it was introduced to that system, according to tradition, by one of the canonized saints of **LAMATISM** as part of a mystic formula which possessed inestimable virtues. The formula runs thus—*Om* (or *Aum*) *Mani Padmi Hoong*, and perhaps no form of words ever devised has been repeated so often by human lips as this, unless it be a variation of the same mystic sentence *Aum-mi to-fush*. The first of these formulas is used throughout Tibet and by some of the tribes of Central Asia, the second being that employed by the Fo-ists or Buddhists of China. These words are the first that are taught to infant children, they are repeated in connection with every duty and every event of life, and dying men eagerly mutter them with their latest breath. These words are engraved all over sacred places, on the face of the rocks, and on the walls of the temples, and they are written upon flags which are hoisted upon tall poles, that as they flutter in the breeze they may offer up acceptable worship to heaven. Every devout Fo-ist desires to repeat the mystic formula at least 300,000 times in the course of his life, and to attain this many of the monks shut themselves up in the temples for months together, and spend the whole of their waking hours in repeating these words over and over again. The laity, too, as they go about their daily business keep the words for ever upon their lips, and in the pauses of conversation upon secular subjects the speakers may be heard murmuring under their breath the never-ending refrain. Even this untiring repetition, however, is regarded as insufficient, and machinery has been introduced to assist devout worshippers. The sacred words are written on strips of cloth or paper, and

wound round and round the inside of a small cylinder, provided with a handle and pivot, so that it may be readily twirled round. These are held in the hand and steadily rotated, each turn being believed to count for the repetition of the full number of prayers inscribed in the accounts kept by the celestial authorities. In the temples immense cylinders of this description, turned by spokes, cranks, or cords, are provided for the use of worshippers, and in many places similar cylinders are set up to be turned by means of windmill sails or water-wheels for the benefit of the neighbourhood. It has been observed wherever these wheels or cylinders are used they are made invariably to turn from right to left, and though it is impossible at present to trace out the intervening links of the chain, there is good reason to believe that in their use we may see the survival also of a custom derived from the primitive worship of the sun. The literal interpretation of the mystic phrase is variously given, some supposing that it means "Oh! the jewel in the lotus, amen," others, "Salvation is in the jewel lotus, amen;" while a third interpretation is that the words ascribe perpetual adoration to Buddha as the jewel on the lotus, in reference to the pattern, symbolical of the lotus or water-lily, with which his throne is always adorned.

OMAHA, the most important city of the state of Nebraska, in the United States, situated on the right bank of the Missouri, which is crossed by a fine iron railway bridge connecting Omaha with Council Bluffs, 4 miles to the east. Its metal smelting and refining works are very extensive, and it has oil-works, pork-packing works, and numerous other factories. The chief buildings are the opera-house, court-house, churches, and several educational institutions. Its population in 1880 was 30,518; in 1885 it was about 100.

OMAR I. (*Abu Hafsa Ibn-al-Khattab*), the second caliph of the Moslems, was the third cousin of Abdallah, the father of Mohammed. He was at first a determined enemy of the Prophet, but after his conversion to Islam he became a zealous and useful adherent, and was admitted by the Prophet to terms of intimate friendship. A bold and resolute warrior, he rendered valuable assistance to Mohammed in his various warlike expeditions, and after the death of the Prophet he prevented a dangerous quarrel by causing Abu-Bekr to be appointed caliph, himself accepting the post of *hajib*, chamberlain or vizier. On the death of Abu-Bekr Omar succeeded as caliph, and he now carried out with determined energy the policy of foreign conquest which he had suggested to Mohammed. The first act of his administration was to recall the celebrated Khaled-Ibn-Walid, surnamed "The sword of Allah," from his Syrian successes, but now become obnoxious for his rapacity and cruelty, as well as dangerous on account of his ambition. Khaled's successor, Abu-Obeidah, zealously prosecuted the conquest of Syria, and before the middle of 637 Damascus, Emesa, Hama, and Kennesin had fallen, and the patriarch of Jerusalem had agreed to surrender the city to the caliph himself. Omar accordingly hastened from Medina to Jerusalem, and having arranged the terms of capitulation made a triumphal entry into the city about the middle of the year. Before leaving he gave orders for the erection of a magnificent mosque on the site of the temple, which still stands as an object of great veneration to the Moslems. The capture of Jerusalem was followed by the reduction of all the principal cities of Palestine and Syria, and during the five years which followed, Persia, Egypt, Khorassan, and Armenia were overrun and added to the new empire, so that by 642 the Mohammedan Empire extended from the desert of Khiva to the Syrtis, a marvellous extension for so short a period. In 644, however, Omar was assassinated in the mosque of Medina by a Persian slave, whose request to be relieved from the payment of the customary tribute he had refused.

Omar was a man of a stern and somewhat gloomy tem-

perament. He lived in primitive simplicity, working at the manufacture of leather belts, living on barley bread, dates, and water, and wearing only an old tattered gown of haircloth. He ate out of the same dish as his followers, and often slept under a wayside tree or on the steps of the great mosque. He observed with great strictness the injunctions of the Koran, frequently conducted public worship, and during his caliphate he performed nine times the pilgrimage to Mecca. He gained the admiration of the Moslems generally by his inflexible administration of justice without respect of persons, and during his reign several of the best Mohammedan institutions had their origin. He commenced the custom of maintaining a regular standing army, paying the troops and pensioning the officers out of the public revenue, and he also established a system of police for the guardianship of the cities of the empire. The practice of computing time from the Hegira or flight of the Prophet originated in his reign. His name is still regarded with the deepest reverence by orthodox Mohammedans.

OMAR KHAYYAM, an illustrious Persian mathematician and poet, was born in or close by Nishapur, and is said to have died there 1123. He enjoyed the friendship of Nizam-ulmulk, the vizier of Alp-Arslan, through whose good offices he received an annual stipend which enabled him to devote himself to study. He soon gained fame as a mathematician and astronomer, and the success of his works on algebra and geometry induced Sultan Malikshah to intrust to him the work of reforming the calendar, and of conducting a series of important astronomical observations. One result of his labours was the introduction of the Seljuk era, which commences in 1079. The fame of his poetry, however, is greater than that of his science, and the collection of about 500 quatrains which came from his pen stands at the head of all similar works produced in the East. Some of these are deeply imbued with Sufic mysticism, of which Omar was a complete master; but most of them are directed against the bigotry, ignorance, and extravagance of both the orthodox and heterodox sects of Mohammedanism. The boldness of his scepticism, his powers of wit and satire, and his sympathies with humanity have earned for him the title of the Voltaire of the East, but he possesses a depth of feeling and emotion far greater than anything displayed by the Frenchman. His mathematical writings and poems have been frequently printed in Europe, and a new English version of the quatrains by E. H. Whinfield was published as part of Trübner's Oriental Series in 1882, a critical edition of the text, with notes, being issued in 1883. An excellent English translation in verse exists by Edward Fitzgerald, published anonymously in 1872; and from this a representative selection of 101 quatrains was made and newly arranged and published in Boston and London (large 4to) in 1884, being accompanied by some remarkably fine and poetical designs by the American artist Elihu Vedder.

OM'AYYADS or **OM'MIADS**. This name is given to the dynasty of caliphs in Syria and Spain, who were descended from Abu Sofian, the contemporary of Mohammed, and the chief of the house of Omayya. Abu Sofian was for a long period the bitterest enemy of the Prophet and of the family of Hashim, from which Mohammed was sprung. His conversion, tardy and reluctant, only took place when Mecca had been compelled to surrender to Mohammed, and considerations of safety, as well as of policy, combined to induce him to adopt the winning side. Moawiyah, the son of Abu Sofian, was secretary to the Prophet in his early youth, and after the death of Mohammed was intrusted with the government of the important province of Syria by OMAR I. In this position he obtained a high reputation for liberality and humanity, and became very popular with the people over whom he

ruled, and after some years of civil war the assassination of Ali, by the hand of a fanatic in the mosque of Kufa, left him sole master of the Moslem Empire, for he had the address to negotiate the abdication of Hassan, the son of Ali, who retired from the palace of Kufa to an humble cell near the tomb of his grandfather. He also changed the succession to the sovereignty of the Moslem Empire from an elective to a hereditary kingdom; and his son Yezid, a feeble and dissolute youth, was, after some slight opposition, proclaimed Commander of the Faithful and successor of the Apostle of God. Under Yezid, Hussein, the son of Ali, and several of his relatives and adherents, were beset and murdered in the plain of Kerbela; but the survivors, when brought before the caliph at Damascus, were honourably dismissed to mingle their tears with their kindred at Medina. Twelve caliphs of the house of Omayya succeeded to Yezid. Under the reign of Abdulmelek coined money was introduced; and under that of Omar II. the graceful and slender minaret added a crowning beauty to the ecclesiastical architecture of the Moslems. The Omayyad caliphate in the East attained its largest proportions and greatest glory under Walid I. But the title of these princes was defective, and their rule unpopular, except in Syria. The founder of their line had commenced his career by rebellion against Ali, the son-in-law and cousin of the Prophet, and his son had cemented the fabric of his power by the slaughter of Hussein, the son of Ali. The eyes of the faithful were therefore turned towards the line of Hashim, the family from which Mohammed had sprung; and the claims of Saffiah, the direct descendant of Abbas, the uncle of the Prophet, were supported by the people of Khorasan and by Abu Moslem, a fierce and skilful warrior, who boasted that he had destroyed 500,000 of his enemies, and whose stern countenance was never brightened by a smile except in the hour of battle. On the field of Turab, 120,000 Moslems under the white standards of Merwan II., the last of the Omayyad caliphs, encountered a far inferior host under the black banner of the Abbasides; but after a desperate struggle the army of Merwan was entirely defeated, with the loss of 30,000 men. He himself escaped from the fatal field, but was closely pursued by his implacable enemies; and after a succession of combats in various parts of the widespread Eastern Empire, he met at last a warrior's death at the battle of Busir, on the banks of the Nile, in 750. The incessant and untiring search and merciless policy of the conquerors sought out and extirpated almost every branch of the family of Omayya, and the death of Hussein was amply avenged. Two only of the royal race of the Omayyads escaped the proscription which well-nigh extinguished the family. One fled to South-east Arabia, where he founded a caliphate which lasted for seven centuries; the other, Abd-ur-Rahman, after a series of romantic adventures, was invited to accept the government of Spain, and landed in that country in the year 755, accompanied by 1000 cavaliers of the Xeneta tribe. He was received by the chief men of Andalusia, who took the oath of allegiance to him, and shouted aloud, "May God exalt Abd-ur-Rahman Moaviah, King of Spain!" Twenty thousand warriors soon joined his banner, and when he appeared before Seville the whole city came forth to receive him, and he was proclaimed king amidst universal rejoicings, while commissioners sent by other cities advanced to assure him of their ready service and faithful obedience. At the battle of Musara he defeated the Emir Jusuf El Fehri with far inferior numbers, and still more decisively vanquished him in a second obstinate and bloody conflict, forcing him to seek a refuge in the mountains of Alpinaxaras; after which he established his capital at Cordova, where his descendants reigned 250 years over Spain from the Atlantic to the Pyrenees. He repressed two insurrections raised against his rule by the former Emirs; and finally estab-

lished his power by the defeat and death of the lieutenant of the Caliph Almansor, who crossed over from Africa to reduce Spain to the rule of the Abbasides. Spain was thus for ever detached from the Eastern Caliphate; but under the Omayyad sovereigns she grew rapidly in wealth, importance, and enlightenment. The best princes of that race were not merely warriors, they were also patrons of literature and the fine arts, particularly of architecture. Abd-ur Rahman III., the greatest of the Omayyads, constructed the city, palace, and gardens of Zehra, 3 miles from Cordova, in honour of his favourite sultana. Twenty-five years and more than £3,000,000 sterling were employed in the work, and 1200 columns of precious marbles sustained or adorned the buildings. Literature was nobly patronized by himself and his successors. The royal library is said to have contained 600,000 volumes. Cordova, Malaga, Almeria, and Murcia gave birth to more than 300 authors, and seventy public libraries were opened in the cities of Andalusia. The royal seat of Cordova contained 600 mosques, 900 baths, and 200,000 houses, and the annual revenue of the kingdom was £6,000,000 sterling, which, in the tenth century, probably surpassed the united revenues of the Christian monarchs of Europe. It was the most prosperous era of the riches, cultivation, and populousness of Spain. The Caliphate of the West fell in the beginning of the eleventh century. The last monarch was Hisham III., and with him the great house of Omayya disappears from history.

O'MEN. a sign or prognostication of future events supposed to be an intimation from a superior power. A belief in omens has existed in all ages and countries, and even at the present day it is almost universally prevalent among ignorant and uneducated people. Possibly even among the educated classes of civilized nations those who are wholly and intelligently free from such a belief would be found on investigation to be in the minority. It has frequently happened also both in connection with nations and individuals, that high intelligence and religious scepticism have co-existed with a superstitious belief in omens. In ancient Rome the belief in omens existed until a very late period, and the writings of its historians contain abundant references to this form of superstition. Many curious instances of the appearance of significant omens are recorded by Pliny, and Pausanias relates at length the omens which announced the fate of the Messenians in their struggle with the Lacedæmonians. Suetonius says that Cæsar in landing at Adrumetum, in Africa, with his army, happened to fall on his face, which was reckoned a bad omen; but with great presence of mind, he laid hold of the ground with his right hand, and kissing it as if he had fallen on purpose, he exclaimed, "Teneo te, Africa" (I take possession of thee, Africa). A similar story, it may be added, is told of William the Conqueror at Hastings.

A belief in omens may be said to prevail universally throughout the East, and this quite irrespective of the different religious systems accepted by the various nations, idolaters, Mohammedans, and Christians being alike implicated. In the backward districts of Europe the peasantry and fishermen generally pay a special regard to omens, and the same must be said of the population of some portions of the United Kingdom.

To enumerate the different signs which have been classed as omens significant of good or evil fortune would require more space than we can command, but it may be observed that their interpretation is very arbitrary, and the event which in one district or country is regarded as a sign of disaster, is often found in another place accepted as a sign of good luck. Some omens appear to represent stray and distorted survivals of the beliefs of primitive fetichism or idolatry, while others may be traced to certain definite historical events or simple natural causes. Thus the widespread superstition that if a party of thirteen sit down

to table together, the death of one member will follow within a year, is not unreasonably traced to the Lord's Supper and the fate of Judas which followed that event, and the not unlikely coincidence of a death following such a party within a year would, whenever it happened, naturally strengthen the superstition. We may readily see also that when disaster was associated with this particular number further developments of the idea would follow, and it would come to be regarded as unlucky. Even in a city so civilized as Paris houses are sometimes numbered 12 *bis* instead of 13 by the authorities at the request of the occupier or owner of the property.

Among our superstitious ancestors, scarcely anything failed in some way or other to become ominous. In the *Spectator* is a charming bantering essay by Addison on some of the minor domestic superstitions of his day. Even now it is not easy to start an enterprise on a Friday involving any number of persons, without finding some one who would prefer another and less unlucky day. The crime of Good Friday weighs upon the day still. Of less dignified but far more ancient origin is the importance attached to sneezing; this is alluded to in the famous sneeze of Télémaque, which echoes so sonorously through one of our oldest books, the *Odyssey*, where it is recorded that he sneezed to the left. Had he sneezed to the right, all would have been lost. So also confidence was restored to the famous "Ten Thousand" of the *ANABASIS* by a fortunate sneeze completing a brilliant harangue of Xenophon. It was with a sneeze that the first man came to life when Prometheus brought the fire (soul) to him from heaven, so says the Greek mythology, and ever after that men said, following the example of Prometheus, "bless you" to the sneezer. This custom of averting ill-omen from a sneezer by an immediate blessing is of astonishing antiquity and world-wide prevalence. Even in remote parts of Africa and Asia it is as punctiliously observed as among the Greeks and Romans, and in our own country villages.

The omens given by the moon are another very large class. That a change in the moon means a change in the weather, that a sharp-horned moon means wind, and a crescent-moon lying on her back means storm, are known to all; and so is the still more fatal sign of the "new moon lying with the old moon in her arms," which throws its ghastly glamour over the ancient ballad of Sir Patrick Spens, and refers to the not very unfrequent occurrence of the dark hemisphere of the moon showing faintly in the sky. To look at the new moon for the first time through glass is a terrible danger, and needs instant propitiation, according to various recipes, such as turning the finger-rings, &c. It is bad also to catch sight of the new moon on the right, but good to see her for the first time on the left. But the subject is too intricate for more than this brief indication.

Very ominous of ill are the spillings of salt upon the dinner table, though it is a little uncertain as to whether the danger threatens the spiller or the person towards whom the condiment falls. The best remedy seems, by good authority, to pour wine on the lap immediately (Bishop Hall's "Characters"). The usual resource is, however, to fling a pinch of the salt over the left (i.e. the fortunate) shoulder. This is, of course, a remnant of the ancient pagan sacrifice of salt to avert the anger of the gods. (The use of salted water as "holy water" is of ancient Greek origin.) Spilling wine at table is similarly ominous, and unfortunately is left without ready antidotes.

Our ancestors had not only to be cautious about eating and drinking; in dressing ill omens were also very apt to occur. The proper time to cut the nails was a thing to be carefully computed. Did one sneeze, an instant return to bed was necessary, as St. Augustine himself tells us; and a mistake in taking the right shoe for the left, or in putting on a turned stocking, was very serious indeed. To

wash hands in water used by another inevitably led to a serious quarrel with that person, even were it one's own wife. Evil awaited the man who did not rise upon his right side: "You got out of bed the wrong side" is yet a popular proverb applied to one with whom things go crossly.

Omens from bodily sensations are innumerable. "It was not for nothing that my nose fell a bleeding," says Launcelot in Shakspeare's "Merchant of Venice" (ii. 5). If it bled at the left nostril it was lucky, but woe to him who bled from the right. The left cheek aflame betokened good, the right evil; the left ear burning was because some person was talking well of one at that moment, but if one were suffering from a too candid friend's animadversions, it was the right ear which tingled. So Theokritos, the ancient Sicilian Greek poet, sings, "My right eye itches, shall I soon see my love?" and the witch in Macbeth feels her prey coming into the clutch of her bony fingers:

"By the pricking of my thumbs,
Something wicked this way comes"—*Macbeth*, v. 1.

Fire, with its tricky changeable ways, was the source of omens without number. The Greeks observed the altar flames at the sacrifice with as much anxiety as a country girl watches a "letter" (an irregularity in the wick causing a spark to fly out) in the tallow candle. If the guttering of a candle remains standing in a tall pillar while the main part burns away as usual, it is called a winding sheet, and may import death in the family; much depends on the way in which it falls when the heat of the flame at last overcomes it. It will be remembered how the Vicar of Wakefield laughs at his daughters for seeing rings in the candle, and purses (spuks) bounding from the fire. But such eluder purses may, if of unlucky shape, betoken "coffins;" and the whole significance lies here, as elsewhere, in the interpretation of the omen.

Sounds and movements of animals yield another great family of omens. The ancient AUGUR spent his whole life upon the study of this all-important subject, and became thereby one of the chief officers of state. With ourselves, if a cat or hare, &c., run across our path it is bad for us, no doubt, and a dog howling at night during illness is an omen of death; but we no longer construct treaties nor decide the dates of the year by observing the flight of birds or the sounds of beasts. Omens, in these our later days, if perhaps not much less numerous, tend to become less weighty; a cat washing over her ears betokens nothing worse than rain, and her sneeze only means that every one in the house will certainly catch cold. Rats and mice gnawing one's clothes or one's bedhangings give more serious cause for fear, for this means death to the wearer or to some one dear to him. But when in the days of the Roman republic a frightened citizen told Cato in awe-struck tones how the rats had nibbled at his shoes, the sturdy old senator made light of the matter: "If, however," he added, "your shoes had eaten the rats, I confess I should have been alarmed." Our poets are full of omens of animals; thus Shakspeare, taking one or two cases only out of many:—

"Thou ominous and fearful owl of death."
—*1. Henry VII.* iv. 2.

"The bird of night (owl) did sit
Even at noon-day upon the market place,
Hooting and shrieking."—*Julius Cæsar*, i. 3.

"Oh, it comes o'er my memory
As doth the raven o'er the infected house,
Boding to all."—*O.ello*, iv. 1.

"The raven himself is hoarse
That croaks the fatal entrance of Duncan
Under my battlements."—*Macbeth*, i. 5.

"Augurs and understood relations have
By magot-pyes and cloaths and rooks brought forth
The secret'st man of blood."—*Macbeth*, iii. 4.

(Magot-pye is magpie; *Magot* or Margaret being the name of the pie, as Robin of the redbreast, Tom of the tit, Jack of the ass, &c.)

It is quite beyond the limits of this work to do more than thus briefly indicate some of the main heads of the subject of omens. With the growing conception of the unity of nature, and the simplicity and unfaillingness of God's laws, these special significances of isolated chances must vanish utterly away. Even in their present mild and amusing form they cannot remain.

OMENTUM is a broad band of membrane connecting two or more of the abdominal viscera. The chief of these membranes is the great omentum, or caul, which forms a large fold connecting the stomach with the transverse arch of the colon. Others of less size and importance connect the stomach and liver, and the stomach and spleen.

OMER, ST., a fortified town in the French department of Pas-de-Calais, situated on the Aa, 26 miles by railway south-east from Calais. The population of the town and suburbs in 1882 was 21,556. St. Omer is surrounded by fortifications, between 2 and 3 miles in circuit, protected by marshes, which can easily be flooded. The town is traversed by the canal which unites the Aa to the Lys. The principal streets are broad. The Place d'Armes at the west of the town is the only large square; the town-hall occupies the east side of it. The former Cathedral of Notre Dame, and the church of the former Jesuit college, are the finest of the public buildings. Other remarkable objects are—the ruins of the Church of St. Bertin, formerly the finest Gothic church in French Flanders; the hospitals; the theatre; and the public library, which contains 20,000 volumes. The town has civil and commercial tribunals, a consultative chamber of agriculture, a college, and an ecclesiastical seminary, which has replaced the Jesuits' College founded by Father Parsons for the education of Englishmen. Here Daniel O'Connell was educated with the view of entering the priesthood. The ramparts, which are planted with elm trees, the quays on the banks of the canal, and the Calais road, form handsome public walks. Woollen cloth, blankets, embroidery, thread, oil, glue, fishing-nets, paper, brandy, beer, pipes, soap, leather, and salt are the leading manufactures of the town, which also contains some flour mills, iron and copper foundries, and is likewise the centre of a considerable commerce in wool, corn, wine, flax, coal, &c. The inhabitants of the two suburbs of Haut-Pont and Lîzel, to the north of the town, retain the Flemish language, and are mostly engaged in raising vegetables on spots of ground which they have recovered by draining from the marshes near the Aa. These marshes are very extensive, and great quantities of turf are extracted from them. St. Omer was taken by Louis XIV. in 1677, and during the French Revolution it was called *Morin la Montagne*. Within the walls of the Abbey of St. Bertin the feeble Childeric III., the last of the first race of French kings, ended his days in 755; here also A'Becket sought refuge when a fugitive from England.

OMNIBUS (Lat. *omnibus*, for all), a public carriage which traverses the streets of large towns, for the purpose of taking up and setting down passengers in its route. Omnibuses were introduced into Paris as early as 1662, and for a time they were very successful; but as the novelty declined they fell into disuse and gradually disappeared. They were again revived in 1827, and in a short time after their institution they became eminently successful. They have ever since been maintained there in a state of high efficiency, and the omnibus system of Paris to-day is probably the best in the world. In London they were first introduced by a coachbuilder named Shillibeer, who designed a conveyance for twenty-two passengers inside, which was drawn by three horses abreast. The enterprise, though not a great financial success at the outset, excited the enterprise of other coachbuilders, and they

entered into keen competition with each other, and soon different forms of the vehicle appeared. The longitudinal seats on the roof were added in 1849, the more comfortable cross seats not being introduced until 1881.

The omnibus service of London is chiefly in the hands of a powerful corporation called the London General Omnibus Company, established in 1855, which for some years almost succeeded in monopolizing the whole of the traffic. More recently some rival companies have succeeded in establishing themselves, and on the principal routes one or two large private proprietors, and a considerable number of smaller owners, run their vehicles more or less at discretion. An immense business is also done by the tramway cars, which now form a prominent feature in the streets of most large cities. See TRAMWAY.

OMNIVORA is a section of *ARTIODACTYLA*, a sub-order of *UNGULATA*, containing three families, Hippopotamidae, Suidae, containing the pigs and peccaries, and Anoplotheriidae, containing the extinct genus *ANOPLOTHERIUM* and other extinct genera. The Omnivora form a well marked group, distinguished from the rest by the absence of the ruminating habit and the tubercular character of the molar teeth. See HIPPOPOTAMUS, HOG, PIG, PECCARY, &c.

OMSK, the chief town of Western Siberia, in the province of Akmoïinsk, is situated on the right bank of the Irtysh at its junction with the Om, 1800 miles east of Moscow. The town is an administrative centre, is fortified and well built, and has a military and a Cossack school, and a considerable trade, chiefly with the nomadic Kirghiz, who inhabit the steppes to the south. The population is about 30,000.

ONAGRARIÆ is an order of plants belonging to the *POLYPETALÆ*, cohort *MYTALÆ*. The species are chiefly herbaceous plants, inhabiting the more temperate parts of the world, and have white, yellow, or red flowers; such, for example, as the great genus of *Euthanasia* or Evening Primroses, and the *Epilobium*s, which are so common as wild plants. It is only in the *Fuchsia*, which has a succulent fruit, and forms an approach to *Myrtaceæ*, that a woody structure is met with. In this order the parts of the flowers are regular, and generally in twos or fours; the lobes of the calyx are valvate, and the tube adnate to the ovary; the petals are fugacious; the stamens one to eight in number; the ovary is inferior, two to four-celled, sometimes one-celled, with incomplete septa. The style is undivided; the ovules are numerous or sometimes solitary in the cells, and the seeds are without albumen. See *EPILORIUM*, *FUCHSIA*, *EUTHANASIA*.

ONCIDIUM is a very large genus of tropical and sub-tropical *ORCHIDÆÆ*, found in America, where the species are common, especially in Mexico and some of the West India Islands, Brazil, and Peru. They have usually yellow flowers spotted with a rich reddish-brown; sometimes the blossoms are purple, and more rarely white. The most remarkable species is the Butterfly Plant (*Oncidium Papilio*), so called in consequence of the supposed resemblance of its flowers to some insect upon the wing. This is found in Trinidad, growing on the branches of trees. It is commonly grown in hothouses, and is closely related to *ODONTOGLOSSUM*, but differs in the lip-claw diverging from the column, and the column being short, with two wings at the sides of the stigma. There are over 250 species.

ONEGA LAKE, a considerable lake of Russia, being next to that of Ladoga, the largest in Europe, in the centre of the government of Olonetz. Its length is about 140 miles, and its breadth from 30 to 59 miles. The area is estimated at 3800 square miles. Its shores, which are generally rocky, present several deep bays and gulfs; and there are numerous islands near its northern extremity. Its navigation is impeded by sand-banks, but it is less subject to storms than Lake Ladoga. It discharges at its south-

west end by the Svir into Lake Ladoga, and has inland water communication by rivers and a canal with the Volga. The river Onega has no connection with the lake. It rises in Lake Charonda in the government of Novgorod, and after a north-east and north-west course of 270 miles, enters the Gulf of Onega, the most southern arm of the White Sea, at the small town of Onega, where there are saw-mills and an export of timber. It is navigable throughout.

ONEILS, THE, of Ireland. See IRELAND, section *History*, subsection *Colonization of Ireland*.

ONION (Fr. *oignon*, from Lat. *unio*, a pearl, also used for a kind of onion). The species from which the varieties of the common onion have been derived is the *Allium Cepa*. [See *ALLIUM*.] Its leaves and roots are of an annual nature, since they die in the course of a single summer, after perfecting a bulb; the latter, however, is biennial, and capable of putting forth fresh roots and leaves in the following season, and of acquiring an increase in its size. This property is taken advantage of in one of the modes of cultivation. The native country of the onion is not certainly known, but A. De Candolle supposes it to be Western Asia. In India and Egypt it has been cultivated from the remotest antiquity. It was introduced into Great Britain at a very early period. The range of latitude within which it may be grown extends from the tropics almost to the coldest verge of the temperate zone.

Onions will succeed in any good rich soil, provided it be neither too wet and adhesive, nor, on the other hand, too dry and light. They may even be grown successively on the same spot for a number of years, contrary to what happens with the majority of crops. Abundance of well-prepared manure should be thoroughly incorporated in digging the soil. The dung of pigeons and poultry is used with advantage; but some, particularly the French gardeners, prefer sheep-dung.

The time of sowing the general crop is from the middle of February to the middle of April, according to the state of the ground and the weather, but early sowing is best. Onions intended for pickling should be sown thickly on poor and dry soil. The silver-skinned, yellow, and two-bladed onions are the best varieties for this purpose.

For a supply of young onions in spring, the sowing should be made in August. Onions are sometimes attacked by a grub at the root. Trenching the soil to a good depth, soot, charcoal-dust, and lime-water have severally been successfully applied as remedies. Very large onions may be obtained by sowing thickly in April on poor soil, so that the produce in the first summer may be of small size. The crop is then taken up in the usual manner, and the smallest and finest are selected for planting in rich and well-prepared soil in the following spring.

The imports of onions into the United Kingdom amounts to over 3,000,000 bushels, valued at £550,000 per annum. Nearly the entire quantity is received from Holland, Belgium, France, Spain, and Portugal.

ON'KELOS, the traditional name of the author of a famous ancient version of the Pentateuch in Aramaic, generally believed to be due in its present form to the Babylonian schools of the third and fourth centuries of our era, and to have been partly written about the second century. It contains curious commentary passages interwoven with the text. Many copies of it, some very old, exist in MS.; but it still awaits an authoritative exposition. As yet it has not yielded anything of great value, but that may be for want of study.

ONOMAK'RITOS (520-485 B.C.), the real author of the Orphic religion. The sons of Peisistratos employed him to collect the oracles or oracular poems of Mousaios (Lat. *Museus*), the son of Orpheus, and those attributed to the demigod himself. There is no doubt that he wrote much and altered still more by rearrangement. Finally an alteration more bold than usual brought him into dis-

grace with the tyrants, and he was banished to Persia. Xerxes received him favourably, and used him to search out all the prophecies apparently leaning towards an invasion of Greece.

ONOMATOPEIA (Gr. *Onomatopoiia*, *onomatopoiia*), which literally means "the making of words," is the name given to those words which are formed, or supposed to be formed, by an imitation of natural sounds. Thus, the words "to neigh," "to murmur," "to bleat," "to croak," and many others, are supposed to be merely imitations of natural sounds; but the number of such words has been greatly exaggerated by some grammarians. Ennius, the ancient Latin poet, imitated the sound of a trumpet by a word, adopted in most modern languages, *tarantara*; and Aristophanes hits off the croaking of frogs by *brekekkek-kouk-kouk*. Many examples might be adduced from our own poets, and the effect, when skillfully employed, is very pleasing. The chief words of the sort in English are ding-dong, ting-ting, tick-tuck, twang, whack, whiz, thud, slap, splash, clank, puff, &c.; mew, bow-wow, purr, caw, croak, cuckoo, to-whit, to-whoo, cock-a-doodle do, &c. (The last seems far preferable to the German *kikeriki*.)

ON'SLOW, GEORGE (1784-1853), a musical composer, who is usually reckoned among the French writers. His father was English, but his mother was French, and he was born and died at Clermont Ferrand, in the Puy de Dôme. He studied the piano-forte in London and operatic composition in France, but made no way as a composer till he took to writing chamber music for strings. Here his correct style and exquisite taste had full play, while the demands of larger fields upon the imagination did not exist to baffle success. He has left thirty-four string quintets (usually with a double bass as the fifth part), and thirty-six quartets, besides much similar music for other instruments. By these he is known and loved, while his orchestral and stage work is already forgotten.

ONTARIO is the name by which the western or upper section of old Canada is now known. It is a relic of the significant and sonorous language of the Wyandot Indians, who formerly occupied so much of its territory, and means the "beautiful land." It occupies the fine country which stretches north and west of the great lakes Ontario, Erie, and Huron, and is bounded on the east by the Ottawa River, which separates it in that quarter from Quebec. It has an area of 107,780 square miles, and had a population of 1,913,460 in 1881.

The country is mainly suited for agricultural cultivation. It is nowhere mountainous, but gently undulating, and diversified by rivers and lakes. The Laurentian mountain chain, so often referred to, extends westward from the Thousand Isles, near Kingston, and northward of Lake Simcoe, forming the coast of Lake Huron and the Georgian Bay. Another ridge of high land, which enters the province at Niagara Falls, is extended to Hamilton, and thence to Owen Sound, and along the peninsula to Cabot Head and the Manitoulin Islands. The water system of Ontario embraces the grandest lakes and some of the largest rivers in the Dominion. Independent of Superior—which, though invariably claimed by her, belongs of right to territory west and south of her present boundary—her largest lakes are Huron, Erie, and Ontario. Next to the St. Lawrence and Ottawa, which form the frontier lines on the south-east and north-east, her principal rivers are the French, the Severn, the Magallowan, which fall into the Georgian Bay; the Maitland, Saugeen, and Aux Sables, flowing into Lake Huron; the Thames, emptying into Lake St. Clair; the Grand into Lake Erie; the Trent and Moira into Quinte Bay; and the Niagara into Lake Ontario.

Wheat, barley, pease, coarse grains, roots, and grasses of all kinds thrive finely. Fruit, particularly apples, afford an increasing source of wealth to cultivators. The grape

is indigenous. Maize or Indian corn, tomatoes, melons, and other products requiring a high summer temperature to bring them to maturity are grown in some of the more favoured counties. Dairy farming and stock raising are becoming of great importance. Ontario is richly endowed with forests of valuable timber, the export of which, though greatly diminished during recent years, still forms one of the main sources of provincial revenue. The timbered areas from which the best qualities are obtained are found in the Ottawa valley, on the shores of the Georgian Bay, and in the backwoods of the Muskoka district. Its mineral resources are also very great and valuable. Copper abounds on the shores of Lake Huron, and silver in the neighbourhood of Thunder Bay, Lake Superior. Large quantities of salt and petroleum are found. TORONTO is the chief town.

The Indians are numerically stronger than in any other province, except the North-west Territories and British Columbia. They number nearly 16,000. Those belonging to the famous Six Nations on Grand River, and the Chipewas of Lake Superior and Huron, are the most powerful. Under the Act of Confederation of 1867, Upper Canada, under its present name of Ontario, became the chief province of the Dominion of Canada. The governing power consists of the lieutenant-governor, an executive council of six members, and a legislative assembly of eighty-eight members, elected every fourth year. Public education is unusually well provided for.

ONTARIO, LAKE, the smallest and most eastern of the five great lakes of North America, lies between Canada on the north and west and New York state on the south and east; length, E.N.E. and W.S.W. 190 miles; breadth, 40 miles; area, 7654 square miles. Its surface is 321 feet below Lake Erie, and 248 feet above the sea. Its greatest depth is 3636 feet, and the navigation is easy, the depth being in general great. It never freezes in winter to any distance from the shore, and it is traversed by steamers and other vessels. It receives many rivers, the principal being the Niagara, Genesee, and Oswego from the south, and the Trent on the north, and discharges its waters by the St. Lawrence, at the north-east end. The shores are mostly gently sloping and cultivated. The chief towns on its shores are Toronto and Kingston in Canada, and Oswego in the United States. It has canal communication with the Ottawa, the Hudson, and Lake Erie.

ONTOL'OGY. See METAPHYSICS, PHILOSOPHY.

ON'YCHOMANCY (Gr. *onx*, a nail; *manteia*, divination), an ancient practice of divination by the finger nails, usually of a young boy. Spots near the top referred to past events, spots in the body of the nail to present events, and spots near the quick to future events. The thumb-nail related to honour, the forefinger to riches, &c. It was easy, by watching the spots as the nail grew, to be sure when the danger or lucky chance, whichever it might be, had passed by. The practice is not even at this day quite obsolete in country districts.

ONYX is a variety of amorphous silica, remarkable on account of its being coloured in well-defined bands of two, or occasionally more, strongly contrasted tints. Black and opaque white, green and opaque white, or red and opaque white, occur most commonly associated, though there are also rarer forms of colouration. The ancients appear to have obtained this stone from Arabia, and possibly also from India; and, though rare in Britain, a few specimens have been met with in the Isle of Skye and Perthshire, and others at the Giant's Causeway in Ireland. As in the case of agates, it is possible to improve inferior specimens artificially, and the requisite banding is often produced by first boiling the stones in honey, and then allowing them to rest for some time in concentrated sulphuric or nitric acids—sulphuric acid when black and white layers are to

be produced, nitric acid when the layers are to be red and white.

ODEYPORE. See **UDUPPI.**

OOLITE (Gr. *oon*, egg; *lithos*, stone), a limestone consisting of small rounded grains, suggestive of the appearance of the roe or eggs of fishes. Each particle consists of a more or less minute central nucleus, surrounded by concentric zones of carbonate of lime, and the structure is produced by a series of chemical depositions of that mineral from water. The process may often be observed in operation in the pools of existing coral reefs, and also in the waters of hot springs, as at Carlsbad in Bohemia. When the constituent grains are large, the rock is known as *pisolite* (pea stone). Limestones having an oolitic structure are of all ages, from the Upper Silurian onwards, but they form an especially conspicuous feature in the middle Mesozoic series of Western Europe, and hence the strata between the Liass and the Wealden are grouped together to form an Oolitic division of the Jurassic system. Good examples of oolites are the fine yellow freestone of Kettering, the Bath freestone, and certain beds of the Portland stone.

OOLITIC SYSTEM. See **GEOLOGY** and **JURASSIC PERIOD.**

OOZE, in physiography, is a dirty-white, unctuous mud, consisting almost entirely of carbonate of lime, and occurring at a depth sometimes of 2500 fathoms, on the bed of the Atlantic and Pacific Oceans. It is formed chiefly by the accumulation of the dead shells (tests) of **FORAMINIFERA**, though mingled, of course, with the remains of other marine creatures, such as sponge-spicules, polycystines, molluscs, &c. The deposit bears an interesting resemblance to the beds so familiar to the geologist as chalk; this formation being also made up chiefly of Foraminifera, and the most prominent genus, *Globigerina*, being especially characteristic of both.

OPACITE. When examining slices of rocks under the microscope [see **PICTURES**] little amorphous patches of perfectly opaque mineral matter are frequently met with. Having no definite crystalline form, and being too minute for chemical analysis, it is impossible to determine their precise nature, and they are thus all included under the indefinite term of *opacite*. The mineral in question may perhaps consist of earthy silicates or carbonaceous matter, or opaque metallic oxides.

O'PAH (*Lampris luna*) is a fish belonging to the family *Coryphæinæ* or *Dolphins*. The opah, or sun-fish, as it is sometimes called, surpasses all the other members of the family in beauty of colour, remarkable as some of them are. The body is compressed and elevated, covered with very small deciduous scales. The back and sides are green, with purple and gold reflections; the lower surface is bluish, covered with round silvery spots, which also are less thickly scattered on the upper surface; all the fins are of a deep scarlet. The dorsal fin is long, and without a spinous portion. The ventral fins are composed of numerous rays and placed rather far back. There are no teeth. The usual length is about 4 feet. The opah is widely distributed throughout the Atlantic, extending far northwards; it also enters the Mediterranean, but seems to be rare there. The flesh is yellowish and of an excellent flavour.

O'PAL is a hydrated variety of silica, and thus closely allied to quartz. It is more or less transparent, generally of a pale tint, and very brittle, and the finer specimens are always remarkable for a brilliant play of colours on the reflection of light from their surfaces. This "opalescence," which may possibly be due to the presence of minute cracks or cavities, renders the mineral of considerable value as a gem, and opal is largely worked as such in the mines of Hungary, Honduras, and Mexico. As an ornamental stone, however, it is not altogether durable, and exposure to

widely different temperatures often results in cracking; continual handling also affects the beauty of its lustre. The variety exhibiting the finest play of colours is termed *precious opal*; *fire opal* produces ruddy flame-like reflections; *semi-opal* is dull and opaque, and without much play of colours; *wood opal* is wood petrified by opal; and *pyrophane* is a variety which, when heated, becomes transparent, but on cooling resumes its opaque character. A glass-like variety is also known, and termed *hyalite* or *Muller's glass*. The finer opals occur in cavities and fissures in various igneous rocks, and sometimes in metallic veins, and others are deposited round the outlets of geysers and hot springs; occasional occurrences in clayey beds and limestones are also recorded.

OPEN NOTES, those notes of brass wind instruments which occur in the natural harmonic scale [see **HARMONICS**], as distinguished from "closed notes," which are artificial modifications of them. See the article **FRENCH HORN**.

OPEN PIPES, in the organ, are those simple tubes, on the principle of the common whistle, which form the bulk of the work; if the pipe be closed at its upper extremity (*stopped pipe*) the tone is lowered by an octave. The pitch of organ stops is always referred to the open pipe; thus 8 foot tone means the pitch of an open 8-foot pipe (or of a stopped 4-foot one).

OPEN STRING is the term used with stringed instruments, as violins, harps, guitars, &c., when the string is vibrating its whole length, not stopped or checked in any way. The open strings of a violin are tuned to *g*, *d*, *a*, *e*, and *c*, and all other notes are produced by stopping the strings at appropriate lengths from the nut or bridge. Some instruments, as the Russian fiddle, the ancient British *crwth*, the hurdy-gurdy, the viol d'amore, &c., have open strings which serve (or served when these instruments were in use), like the drones of a bagpipe, to keep up an unchanging harmony or drone-bass, above which the melody or the harmony proper moved upon strings which were prepared for stopping.

OPEN SCORE, in music, is applied to a score in which every part has a line (stave) to itself. Short score or compressed score is its opposite, when two or more parts are written upon one stave.

OPENSHAW, a manufacturing town of England in Lancashire, situated about 3 miles from Manchester. It has a library and mechanics' institute, a large railway carriage factory and extensive cotton mills, and iron and chemical works. The population in 1881 was 7609.

OP'ERA, a regular drama set to music, always accompanied by scenic representation, and sometimes by dancing. The true Italian or "Grand" opera is entirely musical from beginning to end; but what is called opera in the national theatres of Germany and England, as well as the French *Opéra Comique*, is of a mixed kind—partly spoken, partly sung.

The constituents of an opera, says Rousseau, are, the poetry, the music, and the decorations. But the poetry of an opera had long ceased, until Wagner taught us otherwise in these later days, to be more than a vehicle for the music; and but for the scenery and decorations, the saying of the Abbé Arnaud, that "the Italian opera is a concert of which the drama is the pretext," would be applicable to nine in ten of all productions of the kind that have appeared during the first half of the century. That the opera, whether Italian or French, is the offspring of the Greek drama, is undoubted.

The modern musical drama originated in Italy towards the latter part of the sixteenth century. It came from a society of lovers of classical culture, imbued with all the fervour of the Renaissance, who met at the house of Giovanni Bardi, count of Vernio, at Florence, about the year 1580, to endeavour to revive the Greek drama in all

its splendour. Parchment scrolls were arriving from Greece, rescued from the careless hands of barbarians, for the Ottoman conquest had been complete since 1453, when Constantinople fell from civilization, and Western Europe had awoke to the perception of the value of these treasures. It was clear that the Greek tragedies, at all events the choral (danced) parts of them, were sung and accompanied by instrumental music; and also that the whole tragedy, whether accompanied or not, was declaimed in a musical manner, somewhat after the style of our "recitative." The society meeting at Count Bardi's house, often called the "Florentine Academy," determined to set something in this way; and Vincenzo Galilei, the father of Galileo Galilei, the great astronomer, wrote musical recitative to a poem on the fearful episode of the fate of Count Ugolino as told by Dante in the "Inferno." This surely was as near an approach to the Greek spirit of fateful tragedy as could be gathered from native sources, and marks the fine taste of the society in seeking not to resuscitate dead models, but revive an art by working on the same lines with modern thought and modern forms. Up till now recitative was unknown, the best music was vocal, unaccompanied, and polyphonic. Galilei introduced monodic music as he called it, *i.e.* music for a solo voice, with instrumental accompaniment. A young musician named Caccini followed with more examples in the new vein, now called *aria parlante*, the aim being to give music not so much lovely in itself as in exact accord with the spoken effect of the words; in fact musical declamation. The nearest attempt at musical drama by professed composers at this time was a succession of vocal madrigals for four or five voices, and solos were made by the concealment of all the singers except the actor whom the action of the drama required to be seen. This might seem a misapprehension did we not possess specimens of such curious works down almost to 1600. But in 1597, to test the new solo style thoroughly, a carefully prepared work was produced at the palace of Count Corsi at Florence. Ottavio Rinuccini wrote and Jacopo Peri composed the pastoral of "Dafne." Its success was instantaneous; and finally Peri, aided somewhat by Caccini, produced the first undoubted opera, "Il Morte di Euridice," for the nuptials of Henry IV. of France and Mary of Medici. Rinuccini again wrote the libretto. This opera still exists, and a copy is in the British Museum. It was represented in a very splendid manner at Florence in 1600, and there published in the same year. As Caccini is sometimes credited with this opera, it is well to note that after helping his friend Peri, he set the whole libretto himself and published it, though it was never performed, in 1600. The Bolognese dispute with the Florentines the honour of having first produced a musical drama, but it appears that the "Euridice" was performed in their city the year after it had been produced at Florence.

These early attempts were quite thrown into the shade by the work of Claudio Monteverde, maestro di capella to that splendid prince Francesco Gonzaga, duke of Mantua. Monteverde was a trained musician, but his madrigals and motets had failed to gain distinction. No sooner had he turned to the new style, however, than he made a complete revolution in music. His first opera, "Arianna," written to Rinuccini's libretto for the marriage of his patron the duke to the Infanta of Savoy, in 1607, created a *furor*. He was at once petitioned for a second work, and in 1608 he produced the renowned "Orfeo," which raised the opera to the dignity of a grand work of art. The scanty orchestra of a half-dozen instruments round a lute or harpsichord was replaced by thirty-three instruments of thirteen different sorts, rarely playing all together, but rather used to maintain a constant diversity of "tone-colour," and frequently (though not, as has been said, invariably) characterizing the entry of certain performers by a markedly peculiar group of instruments. Orfeo himself frequently

has two bass viols to support him, Euridice is accompanied by large guitars, &c. The complete score was published in 1609, and republished in 1613; it is a copy of the latter which is one of the choicest treasures of Buckingham Palace Library. Monteverde introduced novel harmonies, the free use of the dominant seventh for example, and many of our most favourite orchestral devices, such as the tremolando of the violins in agitated passages, the use of the pizzicato, &c. The bulk of his work was produced at Venice, whither he had removed in 1621. The first public opera-house was opened at Venice in 1637, and Monteverde and a pupil of his, Cavalli (the pet name or nickname of Peter Francis Caletti-Bruni), wrote for it continuously. Other opera-houses sprang up over Venice before the century was out. Cavalli left the old monodic style for airs such as we now enjoy, and his gift of melody was so exuberant that forty operas are known to have flowed from his pen, twenty of which are still preserved at Venice. Rome had its first opera-house in 1671, previous performances having been given in a rough way from carts in the street, as we know from Della Valle, who started such performances in 1606. By the close of the century two more were opened. Naples began its opera in 1646, and Bologna in 1680. Thus opera, which at the beginning of the century was the costliest entertainment of princes, had become before 1700 the joy of the people at large.

Now was the time that the immortal Alessandro Scarlatti gave music, through the opera aria, its modern habit of thought. The famous Christina, queen of Sweden, had taken the fancy to turn Catholic, and was amusing Rome with her eccentricities: it was at her palace in Rome, in 1680, that Scarlatti produced his first opera. Stradella at Naples, Caldara and Lotti at Venice, Bononcini at Bologna, and Freschi at Vienna were his contemporaries. Greater than all these last, because more original, and dear of course especially to us, is the Englishman Henry Purcell, who elaborated from the masque, which Lawes had set to music ("Comus"), and the play-choruses of Locke ("Macbeth"), a distinctively national style of opera. His "Dido and Æneas" (1677) is one of the first; his "King Arthur" (1691) perhaps one of the best. It is a lasting disgrace to England that this wonderful man had so few successors, and that he is only now beginning to be properly appreciated. Purcell stands far before any composer of the time in every respect whatever, save Scarlatti alone.

The opera, in England the child of the masque, in Italy the outcome of tragedy, was in France the development of the ballet. Lulli, an Italian page of a niece of Louis XIV., rose to favour by his ballet-music, and in 1672 was put at the head of the Academy of Music. Here he began seriously to write operas, his "Pomone," the first French opera (1669), having been a comparatively slight work. The taste of the court compelled him to use dance rhythms and clear-cut melodies, characteristics which still mark the French stage, and he invented the older form of overture—introduction, allegro, and minuet (or march) to close—which lasted for some generations.

German opera begins rather earlier than the French, with a setting of a translation of the old text of Rinuccini's "Dafne" by Heinrich Schütz in 1627, for the marriage of the Landgrave of Hesse. This was followed by several operas by German composers to Italian words. The first public German opera was Theile's "Adam und Eva," given at Hamburg in 1678. Hamburg now became the headquarters of opera in Germany. Keiser wrote over 100 operas for it, and Handel won his spurs under Keiser there in 1705 with "Almira" and "Nero." But Handel deserted to the Italians, and it is to Keiser, who wrote steadily until 1734, that the German school of opera owes its true foundation.

The Italian opera made its way to London by slow and cautious steps. Public opinion, except among the higher circles, where novelty is everything, did not favour it at first; and it was attacked by a host of critics and wits. In July, 1703, Italian intermezzi, or "interludes and musical entertainments of singing and dancing," were performed at York Buildings. Two years after, "Arsinoë," translated from the Italian, the dialogue and narrative parts in recitative, and the singers all English, was produced at Drury Lane. In 1706, "Camilla," also a translation, was performed by the same persons in a similar manner. At length, in 1710, "Almahide," written wholly in Italian, and performed exclusively by foreign singers, was presented to the public at the Queen's Theatre in the Haymarket. Thus the Italian opera gained a settlement in this country; it soon became firmly fixed, and now seems to be quite as necessary, as a source of amusement in the metropolis of this kingdom, as any other favourite and long-established entertainment.

In 1711 Handel brought out his "Rinaldo" at London, the finest work of the kind then produced. How England went mad for the "Signor" and his Italian operas has been amply detailed elsewhere [see HANDEL], as also the attempted rivalry of Bononcini, &c. In all, Handel wrote forty two operas before he quitted the boards for the sublime regions of oratorio; and it is only gradually that we are discovering how much of his operatic work he has managed to utilize in the nobler field. Almost contemporary with Handel, but a little later, was the excellent and prolific composer Hasse, who wrote chiefly at Dresden, and produced in all over 100 operas; while in Italy Leo, Vinci, Porpora, and the great Pergolesi worthily continued the work of Scarlatti. The "finale" now made its appearance, curiously enough in the work of a comic writer (Loggrosino), who always wrote in the Neapolitan dialect; and it was not long before this excellent idea was adopted by Paisiello and all succeeding composers of serious opera.

Meanwhile opera, which began in a revolt against formalism, had itself become formalized almost to lifelessness. The use of male soprano, the constant straining after bravura effects, and the carelessness of suitability (so that one of Handel's most superb airs, the famous "Largo," is written to the words "Cuo vegetabile," &c.), all dragged down the opera from the high level it might attain. This period of formalism it was, however, from which burst forth perhaps the greatest operatic composer, as far as dramatic power goes, that the world has yet seen, the immortal Gluck, who wrote his splendid "Orfeo" at Vienna in 1762, at once stamping the pattern of genuine opera for all time. Since then operas have been fine, or merely temporarily successful, in proportion as they have approached or receded from the lines of Gluck. "Alceste" (1767), "Iphigénie en Aulide" (Paris, 1771), and "Iphigénie en Tauride" (1779), are other masterpieces, still the delight of students and composers. The "Orfeo" is produced occasionally, and portions of these great works are very frequently given in concert-rooms. The temporary rivalry of Piccini is spoken of elsewhere [see GLUCK] and was a mere fashionable freak of Paris. Italy at this time boasted the sweetness, the pathos, and the racy humour of Cimarosa, whose "Matrimonio Segreto" is still a much-admired work, and parts of which are often heard in our concert-rooms.

Cimarosa belongs to the past, but a composer whose brief career closed before his, though it began after it, begins the era of the present. This is Mozart, the exhaustive treatment of whose life and work elsewhere precludes the necessity of staying further here than to point to the Italian operas "Idomeneo" (1781), "Nozze di Figaro," and "Don Giovanni," and to the German operas "Die Entführung aus dem Serail," and the last of this great series, "Die Zauberflöte" (1791), as miracles of art which

still enthral our senses with never-ending delight. One master only can fairly be held to have surpassed Mozart, and his is the loftiest soul which ever manifested itself through the tone-world, the soul of Beethoven. Beethoven's "Fidelio" (1805) is certainly one of the grandest and most profound, as it is one of the simplest works of art ever penned; and it is characteristic of the two men, that while Mozart wrote heavenly strains to the rubbish of the "Magic Flute," or the libertinism of Don Giovanni and Almahide, Beethoven celebrates the purity and devotion of married love; that, and that alone—for he never wrote a second opera. Later on, another chaste soul, Mendelssohn, tried all his life to get a pure libretto, and actually never wrote an opera at all, except a youthful work which he desired to be forgotten. Cherubini's "Les Deux Journées" and his noble "Medea" are also not unworthy of this great age; nor must Spontini's "Vestral" be passed by without acknowledgment as a great work.

Immediately succeeding these giants of art we find Weber, equally great in his way, with the romantic German operas "Der Freischütz" (1821) and "Euryanthe" (1823), and the English "Oberon," produced in London to Planche's libretto in 1826. Spohr, Marschner, and Lindpaintner wrote finely at this time for opera; the works of the first having suffered unmerited neglect. In the Italian school the great Rossini carried all before him, after "Tancredi," produced at Venice in 1813, had brought Europe to his feet. It was not long before everything else was for a while driven from the boards; and this tyranny of the great melodist lasted until, with his last and greatest work, "Guillaume Tell" (Paris, 1829), he suddenly left the stage. The florid, captivating, somewhat superficial style, the easy dramatic effect, and incessant tuneful melody which Rossini set as the fashion was followed to the full by Donizetti (died 1848) and Bellini (died 1835), and at a later time still by Verdi. Though the rapid falling off in a popularity once so phenomenal is to be regretted on some grounds, it is manifestly a just doom; since scarcely one of these works, except "Guillaume Tell" (and perhaps the "Barber of Seville" should also be added), has any pretence to be constructed upon the true basis of opera—i.e. drama expressed through music. This is not to say that here and there magnificent and true scenes and passages are not to be found, for these composers were real men of genius, but unhappily, led away by an illustrious example, they worked upon a false method, and in less than half a century their operas sound old-fashioned, while Gluck's writings, now a century and a quarter old, are still sources of unqualified delight and admiration; and Mozart's work, written more than a century ago, seems as fresh as ever on our boards.

In France, Rossini, who closed his career there, was followed by Auber, delightful as he was clever, by Halévy, by the neglected colossal genius of Berlioz, and by the enormously eclectic Meyerbeer. The stupendous works of the last-named composer are too near to us to judge them, but it is to be feared that their want of unity may in time hurt their undoubted claim to be held as works of genius. Since Meyerbeer (a German by birth, but a Frenchman in art) France has boasted at least one operatic composer of the first rank, Charles Gounod, whose grand opera, "Faust," seems almost a musical embodiment of the latter half of this century, under the guise of an antique story. Bizet's "Carmen" and Thomas' "Mignon" are also productions of modern France of the highest merit.

Undoubtedly the dominant personality in the opera of to-day, and, it is hoped, its regenerator from the Rossinian quagmire, and its restorer to the paths of Gluck, is Richard Wagner. His work is elsewhere fully discussed [see WAGNER], and it is easy to find fault with it; but most of the main principles which Wagner has laid down are incontestable. The giants against whom he advanced, sling in

hand, but a few years back, have already fallen, while his own work is yearly rising in popularity. It is, however, not so much for what he has done, though the "Flying Dutchman," "Tannhäuser," "Lohengrin," the "Master-singers of Nuremberg," and the "Nibelung" series are wonders in themselves, as for what he has taught, that opera has reason to bless Richard Wagner. The only danger lies in a slavish imitation of merely personal peculiarities of a great man.

To conclude this article, it is necessary to take up the art in England, and see what Englishmen have done since Purcell, the equal of Scarlatti, the superior of Lully, set his compatriots a noble model. Alas! that model was neglected. The splendour of Handel's genius drove all native art aside. The successor of "King Arthur" was a mere string of popular ballads adapted to a dramatic sketch of Gay by Pepusch, and called the "Beggars' Opera." A little better was done by Arne, who avowedly imitated Handel's Italian operas, instead of following Purcell's model. Consequently his attempt, in spite of his great genius, failed. Storace and Dibdin fell back on the ballad style. "The Waterman" (1774) and the "Quaker" (1775) of the latter are excellent in their simple fashion, but they are merely plays with a few songs interspersed. Sir Henry Bishop wasted his truly noble powers upon the same worthless form of art. Balfe raised English opera to a more respectable pitch with his "Bohemian Girl" (1813), and Wallace quite equalled him with "Maritana" (1815). Benedict's "Lily of Killarney" (1862) is also a work of great merit in this style, and Benedict was not an Englishman though he wrote in English. We only wait for the mantle of Purcell to descend upon some worthy successor for England to spring to the first rank in opera. It is acknowledged that no such performance can be obtained elsewhere as is to be had in our own opera-houses, and of late years at least one completely successful attempt, long-continued, has shown that Englishmen will cordially support operas produced by native artists and in the native tongue, through the medium of translations. Meanwhile our chief writers spend their energies upon the elaborate musical setting of exquisitely funny satirical operettas, and succumb to the temptation of large pecuniary rewards at the expense of immortal fame which they might win, and English opera waits its hero.

OPERA-GLASS. See TELESCOPE.

OPERCULUM. In botany this term is chiefly used for the cap which forms the upper extremity of the theca, or sporangium, of a moss, covering over the peristome, and usually falling off when the spores are ready for dispersion. It has also been applied to the lid which covers in the pitcher of *Nepenthes*, where it is the lobe of a modified leaf.

In conchology, a plate developed on the upper surface of the hinder part of the foot in many of the *GASTEROPODA*, closing the aperture when the animal withdraws into its shell. It consists of a horny layer, on which, in some cases, calcareous matter is deposited. Some of the various forms of opercula are shown in Plate II. of *MOLLUSCA*.

OPERETTA (Ital., little opera) is the name given in England to what is in France called *opéra comique*, that is, a mixture of dialogue with separate musical pieces. But while on the one hand the *opéra comique* tends to become grand opera, so that very many works written originally in the slighter style have been connected by recitatives, &c., and have passed thus into the more elevated style, the operetta becomes yearly simpler in form. Frequently a chorus is altogether dispensed with, and the orchestra is reduced to a pianoforte, a harmonium, and a few strings, the actors being few in number, and the piece brisk, generally witty, and short. An operetta has often only two, never more than three acts. There is, of course, no limit to elaboration if the composer is willing and able to provide it; for instance, the long series of comic operettas of

Sullivan (written in collaboration with Gilbert, the satirical poet) are all lavishly mounted both on the stage and in the orchestra, and contain carefully prepared effects.

OPHICLEIDE, *ie.* "keyed serpent" (Gr. *ophis*, a serpent, and *kleis*, a key), a musical instrument made of brass, invented by Fricot in London, in 1790, and intended to supersede the old wooden serpent—on which it is a vast improvement—in the orchestra and in military bands. It has a conical tube, and is of various sizes, the longest nearly 9 feet in length, terminating in a bell, like the horn. It has ten ventages, or holes, all of which are stopped by keys, similar to those of the bassoon, only of larger dimensions, and is furnished with the same kind of mouth-piece as the trombone. The scale of the bass ophicleide is B to *c'* above the line, or three octaves and one note. The volume of sound it emits is immense, but the tone is rich and round, and blends well with the voices in choruses.

OPHIDIÆ. See SERPENTS.

OPHIDIIDÆ is a family of fishes belonging to the order ANACANTHINI, distinguished by having only one dorsal fin and the ventral fins rudimentary or absent. This family includes sixteen genera, placed by Dr. Günther into five groups. In the first group, *Protulina*, the ventral fins are present, attached to the shoulder-girdle; it contains the genus *Lucifuga*, blind fishes inhabiting the subterranean waters of caves in Cuba. In the group *Ophidiina* the ventral fins are reduced to a pair of bifid filaments attached to the lower jaw-like barbels. The Bearded Ophidium (*Ophidium barbatum*), about 9 inches long, is common in the Mediterranean, where it is used as food; it is also found, but rarely, on British coasts. The group *Fierasina* is distinguished by the absence of the ventral fins and the position of the vent, which is situated under the throat. The *Fieras* live in the respiratory cavities of star-fishes and sea-cucumbers, in the character rather of mesmates than of parasites, seeking merely a safe habitation and a share of the food which the water brings into their host's body. They are most abundant in the Indo-Pacific, but are also found in the Atlantic and Mediterranean. *Fierasfer dentatus* is found, rarely, on the coasts of Scotland and Ireland. The group *Amnolytina* includes the LAUNCHES or Sand-eels, found on British coasts; they have entirely lost the ventral fins, and have the vent remote from the head. The last group, *Congregadina*, containing only one genus, has also no ventral fins.

OPHIOCEPHALIDÆ is a small family of fishes belonging to the order Acanthopterygii, chiefly found in the fresh waters of India. These fishes are able to survive long droughts. They can live in semifluid mud, rising at intervals to take in air. There is no special branchial organ present, as in the Climbing Perch (*Anabas*), but merely a cavity connected with the gill-chamber. When the mud in which they live becomes quite dried up they live buried in it in a torpid state, during which respiration is suspended. The body is long and covered with scales of moderate size. The dorsal and anal fins are long and without spines. *Ophiocephalus striatus* is common throughout India. The male constructs a nest of water-weeds, and guards it till the eggs are hatched.

OPHIOGLOSSACEÆ, in botany, is a group of vascular cryptogams which has two representatives in this country—ADDER'S-TONGUE and MOONWORT. [See *CRYPTOGAMIA*, Plate III., figs. 16, 17.] This group was formerly classed with the *FERNÆ*, but they are distinguished by the prothallium, which is not green, being produced underground, and by the sporangia being produced on a branch of the leaf. The venation of the fronds is straight, not spirally coiled as in ordinary ferns. Besides *OphioGLOSSUM* and *Botrychium*, there is another genus, *Helminthostachys*, which is found in the East Indies, and is used as a pot-herb.

OPHIOLATRY (Gr. *ophis*, a serpent, and *latreia*, worship), a name applied to that serpent-worship which extensively prevailed among the Eastern nations of antiquity. The winged serpent of the Egyptians, Cneph or Cuaphis, was esteemed the good genius and creator of the world (Gr. *Apachodaimôn*), and enters largely into the whole range of Eastern mythology. This kind of adoration appears at one period of history to have been more prevalent than any other; and even existed among the Mexicans and nations of the northern latitudes of Europe. It is difficult to account for its origin, but the most probable idea is that it is a development of totemism. See SERPENT-WORSHIP.

OPHIOLITE or **OPHITE** (Gr. *ophis*, a serpent) is a variety of SERPENTINE containing numerous nests of dolomite or calcite, and thus mottled with white or pale green. The rock is also known as *Ophicalcite*, and, when used for ornamental purposes, as *Verd antique*.

OPHIOMORPHA is an order of AMPHIBIA, containing one small family, Cavellidae, which was for long classed with the serpents (Ophidia). The caecilians have an elongated serpent-like body with no limbs, and small scales embedded in the skin, forming transverse rings. They are subterranean in their habits, feeding on worms and the larvae of insects. The eyes are very small, hidden beneath the skin. In some species, at least, the young breathe by means of gills, but in the adults respiration is always by lungs. The notochord is persistent, and the vertebrae are biconcave, as in fishes. The caecilians inhabit the warmer parts of America and India. *Cavellia lumbricoides*, a native of North America, is about 23 inches long.

OPHIR, a place which was known to the Hebrews and to the neighbouring nations, as early as the time of Job, as producing such an abundance of excellent gold that "the gold of Ophir" became a proverbial expression. (1 Chron. xxix. 4; Job xxii. 24; xxviii. 16; Ps. xlv. 9; Isaiah xlii. 12.) It is generally believed to have been situated in the south of Arabia. It is mentioned in connection with the names of Arabian tribes in Gen. x. 29. The gold of Ophir is mentioned in the book of Job, which is most probably of Arabian origin. The products of the voyage might easily have been obtained from Arabia, for though gold is not found there now, we have the testimony of several ancient writers that it was in former times.

OPHITES (Gr. *ophitai*, serpent-worshippers), the name given to a sect of Gnostic Christians who, in addition to the general doctrines of Gnosticism, maintained a peculiar theory or dogma of their own in respect to the serpent. They identified the Demiourgos or creator of the world with the Jehovah of the Old Testament, and considered him to be a malevolent being, a "son of darkness." Having created man, he was desirous of keeping him in ignorance, and hence confined him in a walled garden; but Wisdom, a divine emanation in the form of a serpent, stole into the garden, and revealed to Eve the secret of how she might gain divine knowledge. Hence they revered the serpent as an embodiment of the divine wisdom, the principle afterwards incarnate in Christ, the serpent that is lifted up. As Jehovah had cursed the serpent which frustrated his plans, so they believed he had stirred up the Jews to put Christ to death. They are said to have mingled Ophite observances with the celebration of the Eucharist, and to have kept serpents for adoration. Originating in Egypt, the sect spread thence into Syria and Asia Minor; and though never numerous, they are believed to have lingered on till the sixth century.

OPHIUCHUS or **SERPENTARIUS** (the serpent-bearer), one of the old constellations, representing a man holding a serpent, which is twined about him. (But the moderns often make a separate constellation of the serpent.) It is not a constellation of any note, containing no star of the first, and one only of the second magnitude.

See PLATE CONSTELLATIONS, both Northern and Southern Hemispheres, on the margin, against the figures XVII. in each case.

OPHIOUROIDEA is an order of star-fishes (STELERIDA). The ophiuroids differ from the true STARFISHES, forming the order Asteroidea, in several respects. The arms are rather appendages of the body, containing no prolongations of the stomach; they are not channelled beneath for the protrusion of the tube feet. The tube-feet have no terminal suckers and are chiefly respiratory, the locomotive function being confined to the arms, by means of which these animals can swim and creep. Most of the ophiuroids, as the brittle-stars and sand stars, have long snake-like arms, which can be readily broken off at the will of the animal. In others, called Medusa's head or basket-fish, the arms are greatly branched, and the subdivisions interlacing form a trellis-work round the disc. Anus and pedicellariae are wanting. The Ophiuroidea are divided into two groups, Ophiuridae and Euryalidae. The Ophiuridae, which are usually subdivided into minor groups, contain the animals known as sand-stars and brittle-stars; they are found in all seas, feeding on Foraminifera and other animalcules, and being preyed on largely by cod and other fishes. The Euryalidae contain the forms with branched arms.

OPHYRS (Gr. *ophrys*, an eyebrow), a genus of plants belonging to the order ORCHIDACEAE. *Ophrys apifera* (bee orchis), one of the handsomest species of orchidaceous plants, is a native of England and Ireland. It grows on chalky soils. *Ophrys arachnitis* (late spider orchis) is found on chalky downs in Kent. *Ophrys aranifera* (spider orchis) has the lip of a dark brown colour, hairy, and covered with pale or yellowish lines. It is found in chalky places in England. *Ophrys muscifera* (fly orchis) is a slender plant, and grows about a foot high. It is found in damp calcareous thickets and pastures in England and Ireland. There are a number of species native to the Mediterranean region.

OPHTHALMIA (from Gr. *ophthalmos*, the eye) is an inflammation of the eye. Formerly it was customary to describe numerous varieties of ophthalmia, a distinct name being formed for the inflammation of each part or tissue by appending the termination *itis* to its anatomical name; as conjunctivitis, iritis, retinitis, &c. The latter method of nomenclature is still used, but the term ophthalmia is now limited to conjunctival inflammations.

Of all varieties of ophthalmia slight inflammation of the conjunctiva, conjunctivitis, or cold in the eye, is the most common. It may come on without any observed cause, or from the introduction of slightly irritating bodies between the eyelids, or as a result of exposure to cold or draught. It generally commences with a feeling of itching or irritation, followed by a sensation of grittiness or as if there were dust in the eye. The eye is weak and watery, the mucus secreted being sticky and tenacious, so that the eyelids are often stuck together in the morning, and have to be sponged with tepid water before they can be opened. Usually both eyes are attacked, but the affection may begin in one before the other. There is seldom much pain, but the eyes are unable to bear a strong light. When there is any reason to suspect the presence of any mechanical irritant, such as a grain of sand or a cinder, the wing-case of a small insect, &c., the surface of the eyeball and the lining membrane of the lids should be carefully examined, and if such be found and removed, there will seldom be need for further treatment. Where the inflammation arises from cold the eyes should be protected from a strong light and rested as much as possible, and should be bathed every two or three hours with a mild astringent lotion. An excellent preparation for this purpose is that made by dissolving 6 grains of alum in an ounce of distilled water; other approved forms being those made by

adding 2 grains of nitrate of silver or 2 grains of sulphate of zinc to a similar quantity of water. In the intervals the eyes may be bathed with tepid water to keep them free from discharge, and a little soothing ointment may be smeared over the edges of the eyelids at night to prevent them sticking together in the morning. With proper attention the eyes will generally get well within a few days, though bad cases may last a fortnight, the recovery generally being perfect, and leaving no trace of injury behind.

Infantile conjunctivitis, arising in most cases from inoculation with the vaginal secretion during birth, generally comes on about the third day afterwards, the first symptom being a slight discharge from the eyes, causing the edges of the lids to be glued together during asleep. This discharge afterwards becomes thick, yellow, and purulent, and the eye when examined appears red and swollen. It is a serious affection, and one that calls for immediate medical attention, for if neglected it may result in permanent blindness. Treatment consists in washing away the secretion as soon as it collects with tepid water, and the application every few hours, day and night, of an astringent lotion to the conjunctival surface, the eyelids being touched with ointment to prevent adhesion. A simpler plan is to wash away the secretion with a lotion, made by dissolving a drachm of alum in half a pint of water, every hour, or oftener if the discharge requires it, by means of a small syringe. With constant attention and strict cleanliness a good result may be expected, and the majority of cases, when treated in time, end in complete recovery.

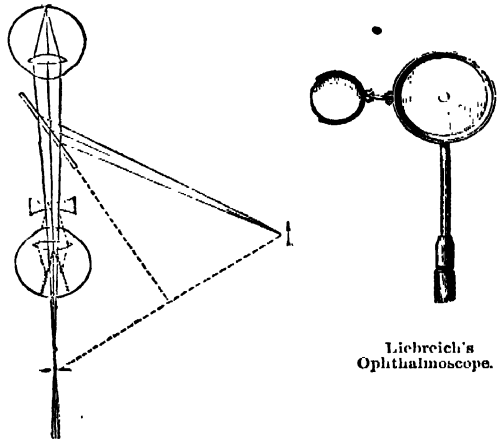
Purulent ophthalmia is distinguished from simple conjunctivitis by the greater severity of its symptoms, the discharge rapidly assuming the appearance of matter, and the eyeball and eyelids being much swollen. There is also considerable constitutional disturbance in the shape of headache, fever, and prostration. It is sometimes called Egyptian ophthalmia, the disease being common in Egypt, from whence it was imported into Europe by the French and British armies at the beginning of the present century. It is highly contagious, and it is said that of the French troops serving in Egypt under Napoleon nearly two-thirds were at one time affected. Of the British troops who returned in 1810 over 2000 lost their sight from this cause. In the expeditions of 1883-85 special precautions were taken to protect the soldiers from this affection. It not infrequently appears in workhouses, pauper schools, convict establishments, in fact in all places where a number of people are herded together and use the same lavatories. Once introduced it will spread rapidly unless prompt measures of isolation are taken, and the results are sure to be disastrous to many of the sufferers.

The treatment of purulent ophthalmia consists in the use of local astringents graduated in strength according to the severity and the stage of the disease, the bodily strength being supported by good diet and tonics, and the pain alleviated by suitable anodynes. Where one eye only is affected the other must be protected, and the strictest cleanliness must be observed by the attendants on account of the highly contagious nature of the discharge. One of the worst forms of this disease is that known as gonorrhoeal ophthalmia, which arises from the inoculation with contagious pus from the urethral or vaginal mucous membrane. The inflammation induced is always of the most severe and dangerous character, and where there is any reason to suspect the presence of this disease the best advice obtainable should be sought without a moment's delay.

Diphtheritic conjunctivitis is a form of ophthalmia which, up to the present, has scarcely appeared in this country, but which is not uncommon in North Germany, and has at times prevailed extensively at Berlin. It is characterized by great heat and pain in the eye, considerable swelling of the eyelids, the growth of a yellowish false membrane on the conjunctiva, and a filling of the cavities of

the areolar tissue with the diphtheritic effusion, causing it to become thickened and almost solid, with a great tendency to sloughing of the cornea. This disease generally attacks weak and poorly-fed children during epidemics of ordinary diphtheria, and it is often attended with fatal results. It is treated locally by the use of ice during the hot stage, which is changed for hot applications as soon as the period of absorption commences, the strength being meanwhile supported by tonics, stimulants, and nourishing food.

OPHTHALMOSCOPE, THE, is an instrument designed to light up the interior of the eye in such a manner as to render the contained structures clearly visible. The first form of the instrument was introduced to the medical world by Helmholtz in 1851. The principle was, that the rays which came from a lamp placed on one side, midway between the observed and observer's eyes, fell upon a



Helmholtz's Ophthalmoscope.

highly polished slide of glass with plane parallel surfaces, and placed at such an angle that the incident rays were reflected into the eye of the patient, and brought to a focus on his retina. Some are absorbed, but the majority are reflected back, and leaving the eye in a direction similar to that by which they entered, many of them in their return pass through the plane glass reflector; but as these are convergent rays, Helmholtz interposes a biconcave lens to scatter them; and having become divergent they fall on the observer's eye, and by means of the humours within are brought to a focus on his retina.

The form of ophthalmoscope now in use was designed by Ruete in the year 1852, and was subsequently improved by the famous oculist Liebreich. Mr. C. Babbage constructed a similar ophthalmoscope in 1847, but his discovery was not made public. It consists of a small slightly concave mirror with a small central perforation, or if the mirror be of silvered glass, with the silvering removed from a small circle in the centre. A series of concave and convex lenses are usually arranged upon a revolving disc, placed behind the mirror in such a way that each of them can be brought in turn before the aperture. Without such an instrument it is impossible to see the deeper structures of the eye, as the rays of light which enter it can only return in the same line, and the head of an observer intercepts the entering rays and throws that which he wishes to see into darkness. The ophthalmoscope, by placing the source of light in front of the observer's eye, enables it to see and examine the interior of the other eye. The examination is made in a darkened room, and a gas-burner or oil lamp is so placed

that it is on one side, slightly behind, of the head of the patient, and on the same level as the eye to be examined. The examiner, sitting in front of the patient, places the back of the ophthalmoscope against his eye, and the reflected light from the mirror entering through the pupil of the eye of the patient reaches him on its return through the perforation.

Two methods of observation are practised, the *direct* and the *indirect*. In the *direct* method the eye of the observer is brought as close as possible to the eye of the patient, the mirror only intervening, and he is thus able to observe the deep structures within their natural positions magnified by their own crystalline lens. It is only when the eyes of both observer and patient, however, are of normal refraction that this can be done without the aid of a lens. If either the patient or the observer be short-sighted or the reverse, the defect must be corrected by a suitable lens. In the *indirect* method the observer takes a biconvex lens, of about 2 inches focal length, and holds it in the track of the returning light, and at about 2 inches from the eye of the patient. He thus produces an aerial inverted image of the fundus of the eye, which image, and not the fundus itself, will be the object of vision to the observer. In order to magnify the inverted image, and to increase its brightness by bringing the mirror nearer the eye of the patient, a convex lens may be placed behind the mirror for the observer to look through.

The ophthalmoscope is an instrument of the very highest value in the diagnosis of diseases of the deep-seated parts of the eye, and there are also a large number of diseases of the nervous system, kidneys, blood, and other structures in which intra-ocular changes occur, which may be observed by its means.

OPIANIC ACID, an acid obtained with cotarnine from narcotine by oxidation. It crystallizes in colourless prisms, having a bitter taste. The formula is $C_{10}H_{10}O_5$. It is soluble in boiling water, in alcohol, and in ether. It melts at $140^\circ C.$ ($281^\circ F.$), and may be distilled unchanged. With bases it forms a number of crystalline salts, called opianates, all of which have the general formula $C_{10}H_9MO_5$. Opianic ether or opianate of ethyl, $C_{10}H_9(C_2O_5)O_5$, crystallizes in needles, melting at $88^\circ C.$ ($190^\circ F.$), and subliming readily. Two sulpho-acids are known.

OPIE, JOHN, the son of a carpenter named Oppy, was born in 1761 at St. Agnes, near Truro, in Cornwall. A rude skill in taking likenesses attracted the notice of Dr. Woleott (Peter Pindar), then a physician at Truro, who received Opie into his house in the double capacity of a protégé and a servant. Opie afterwards came to the metropolis and studied his art closely under the doctor's immediate care and protection. None of his works effect ideal beauty or refined poetical conception, but they are stamped by a peculiar energy of style, and by a vivid realism. He died 9th April, 1807, and was buried in St. Paul's Cathedral, near Sir Joshua Reynolds. His "Assassination of David Rizzio" and "William Siddons" are in the National Gallery. In 1798 Opie married his second wife, Amelia, the daughter of Dr. Alderson, a physician at Norwich. This lady subsequently became one of the most popular novelists of the day.

OPIMUM is a drug yielded by the White Poppy (*Papaver somniferum*). This plant is a native of South-western Asia; but having been cultivated from a very early date, it is now found wild in many parts of Europe. This species is known by its obovate or globular capsules, which are smooth, as well as the calyx; stem smooth and glaucous; leaves embracing the stem, incised and repand, with subobtusate teeth. There are two varieties—the red-flowered with black-seeds and the white-flowered with white seeds. Both yield opium.

The poppy is cultivated in India, Arabia, Egypt, Tur-

key, China, and occasionally in Western Europe, where, however, it rarely succeeds, on account of the uncertainty of the climate. The juice of the plant seems to have been in use in the East as a narcotic from a very early date. The word opium is apparently derived from the Arabic *opion*.

The mode of collecting the drug varies in different countries. The poppy cultivated in the Benares and Behar Agencies is exclusively the white variety (*Papaver muiscerum album*).

In situations favourable to its growth it attains a height usually of 4 feet. The stem is branched, and is terminated by from two to five ovate-globose capsules, averaging in size a duck's egg (fig. 1). The plant reaches maturity in three and a half months, and the time for its cultivation is exclusively the cold season, extending from November to March.

The seed of various districts is changed from time to time.

The sowing is effected between the 1st and 15th of November, the seed being thrown broadcast over the land. In three or four days the plough is passed over the ground to bury the seed, and the soil again levelled. The whole surface is then divided into square compartments, the sides of which are about 10 feet in length, and are raised and converted into channels for the purpose of irrigation.

In February the plant is generally in full flower, and towards the middle of the month, and just before the time for the fall of the petals, these latter are all carefully stripped off and collected. In a few days after the removal of the petals the capsules have reached their utmost state of development, and the process of collection commences. This extends from about 25th February to 25th March. At about three or four o'clock in the afternoon women and children repair to the fields, and scarify the poppy capsules with sharp iron instruments, termed "nushlurs" (fig. 2). The nushlur consists of four narrow bars of iron, each of which is about 6 inches in length and of about the thickness of the blade of a penknife. At one extremity each bar does not exceed a quarter of an inch in breadth; but it gradually expands to about an inch broad at the other end, where it is deeply notched. The sides of the notch are somewhat curved and ground to sharp edges, and the external angles are brought to sharp points. The four bars are bound firmly together with cotton, and the points at their cutting extremities are kept one-sixteenth of an inch apart by cotton thread passed between the blades. Each capsule is scarified from two to six times, according to its dimensions, an interval of two or three days being allowed between each operation. The capsules having been thus scarified, the collection of the juice is made at an early hour in the following morning. The juice is seraped from the surface of the scarifications by means of concave trowels, called "seetooals."

After the plant has ceased to yield any more juice the capsules are collected, and by pressure an oil is extracted from the seeds, which is used for culinary purposes and for burning in lamps. Of the dry cake a coarse description of unleavened bread is made, or it is given to cattle. The capsules, deprived of their seeds, are used for preparing emollient and anodyne decoctions. The stems and leaves are left standing till dry, when they are crushed into a



Seed Vessel and Knife or Nushlur.

coarse powder, and under the name of "poppy trash" employed for packing the opium cakes.

When fresh collected the juice from the capsules presents the appearance of a wet granular mass, of a pinkish colour, and at the bottom of the vessel which contains it is found a dark fluid, resembling coffee infusion, to which the name of "pussewah" is given.

The opium now requires frequent attendance. It is daily exposed to the air, though never to the sun, and is regularly turned over every few days, in order to insure uniform drying of the whole mass; and this process is persevered in for three weeks or a month.

In Asia Minor the poppy cultivated is the variety known as *glabrum*. The incisions in the capsule are made by drawing a knife two-thirds of the way round the capsule. The juice is scraped off the next morning by means of a knife, and wiped off on a poppy leaf. After each cut the knife is wet with saliva to prevent the juice sticking. When the leaf is full, another leaf is placed over it, and it is put away to dry. The harvest varies not merely with the soil, climate, and mode of cultivation, but also with the season and the time of collection. In the wet seasons the yield is less, and the morphia, the most important constituent, is deficient. The time of gathering has also great influence on the quantity of morphia. If the harvest be deferred till the capsules begin to turn white and hard it is very much reduced, and by the time the seeds are ripe it disappears altogether. It is not, as in the case of many other organic bases, transferred to the seeds, which are totally free from any narcotic principle—the oil obtained from them being bland and wholesome, and abundantly used in food.

The varieties of opium met with in commerce are—*Smyrna*, which is generally considered the best, and contains from 10 to 15 per cent. of morphia; *Constantinople*, *Indian*, *Persian*, and *Egyptian*, the latter containing not more than 3 per cent. of morphia. Samples are occasionally met with of English and French growth, which, when the season has been fine, are of excellent quality.

A genuine sample may contain—*morphia*, *codeia*, *narcotin*, *thebaia*, *pseudo-morphia*, *papaveria*, *meconidia*, *narcotin*, *porphyroxine* or *opine*, *meconic acid*, *bassorine*, *gum*, *caoutchouc*, *resin*, besides certain inorganic salts, a fatty oil, an extractive acid, and a volatile poisonous principle not perfectly understood. Some of these bodies are only occasionally present, and some possibly do not pre-exist in the plant, but are generated by the treatment to which the opium is submitted. The most valuable of these constituents are the *morphia* and *codeia*.

Opium is adulterated with clay, sand, gums, water, starch, liquorice, and a variety of vegetable extracts. Sometimes samples occur from which the morphia has been almost entirely removed.

Good opium is not perfectly soluble in water; one-twelfth generally remains undissolved, consisting of the resin, *caoutchouc*, *lignine*, &c. In *Constantinople* opium, however, the *caoutchouc* is absent. When opium is entirely soluble in water it may be suspected to have been prepared by boiling the bruised capsules, and is of inferior quality. The specific gravity of good opium is 1.336, if no considerable mineral impurities are present. It is very inflammable and burns with a clear flame. With alcohol it yields a transparent solution. Opium obtained by bruising and boiling the capsules is not inflammable, and forms a turbid solution with alcohol. When adulterated with *gum-arabic* or *tragacanth* it forms a tremulous jelly if rubbed up with one part of alcohol and two of water.

The examination of a sample of opium turns, not upon the detection of impurities, but upon an estimation of the amount of morphia. For this purpose half an ounce of the sample is cut into fragments and bruised in a mortar with alcohol at 71°. The solution is strained through

lawn, the residue washed with more alcohol. The alcoholic tinctures are mixed and filtered into a wide-mouthed bottle, and mixed with 60 grains pure liquid ammonia. In twelve hours the morphia, with some narcotin and meconate of ammonia, is deposited. The latter is removed by washing in cold water, and the residue is shaken with chloroform, which dissolves the narcotin, leaving the morphia untouched.

The Medicinal and Narcotic Properties of Opium.—

Opium has been used in medicine from a remote period. It is mentioned by *Theophrastus*, the celebrated pupil and successor of *Aristotle*; and *Dioscorides*, about 77 A.D., describes a medicinal extract of the entire herb, together with the more active gum derived from the capsules. At the present day, from its unique qualities and varied uses, it forms the most valuable remedy of the whole materia medica. Administered in small doses, it acts as a powerful and diffusible stimulant, the pulse becoming stronger and quicker, the mind exhilarated, the ideas flowing more rapidly and freely, and there is at the same time an increased capacity for bodily and mental exertion. It is as a stimulant that it is used by the Tartar couriers of Central Asia, who, with a few dates or a lump of bread and a supply of opium, traverse the deserts of that region, and endure hardships and privations which but for the aid afforded by the drug would be intolerable. Even the horses are stimulated by its influence, and the traveller will sustain the energies of his wearied steed by sharing with him the precious drug. In the western world opium is sometimes resorted to for its stimulating powers by preachers and orators, who are enabled by its influence to rise to heights of eloquence otherwise unattainable; but for reasons we shall note presently, the practice is fraught with danger, and can hardly fail to be followed by serious physical and moral injury. Although the first influence of a small dose of opium is to produce bodily and mental excitement, these symptoms are followed by a reaction, in which the muscular power is diminished, the mouth becomes dry, there is a feeling of thirst, and a strong inclination to sleep. In larger doses a short period of exhilaration is followed by languor and drowsiness, soon merging into heavy sleep, which may last from six to eight hours, and is followed by a feeling of sickness, thirst, headache, and a condition of constipation. When opium is administered at once in a dangerous dose, the symptoms begin with giddiness and stupor, generally without any previous stimulus. The stupor increases rapidly in intensity, the patient becoming motionless and insensible to external impressions; he breathes very slowly, generally lies quite still with the eyes shut and the pupils contracted, the whole expression of the countenance indicating deep and perfect repose. As the poison extends its influence, the features become ghastly, the pulse feeble and almost imperceptible, the power of swallowing is lost, saliva and mucus accumulate in the throat, and after a time breathing ceases. The quantity which may produce a fatal effect in persons unaccustomed to this drug is very small, and in children, owing to the rapid circulation of the blood, and the great impressibility of the nervous system, a very minute portion of opium or of its numerous preparations, open or disguised, may cause death. There is no form of poisoning so common as that by opium and its various preparations, *laudanum* being a favourite potion with suicides, while occasionally an overdose is accidentally administered or swallowed in the practice of medicine. In cases of opium poisoning, vomiting should be excited by the use of emetics, and after the stomach has been cleared by this means or the use of the stomach pump, the patient must be prevented from going to sleep by the administration of coffee, hot and very strong, by dashing cold water upon his face and head, and by supporting him on either side, and making him walk up and down in the open air. There is always an irresistible desire to sleep, and this

must be combated by the most energetic measures on the part of the attendants, and their efforts must be persisted in for some hours until the effect of the drug has passed away.

It has been observed that some birds and animals are almost impervious to the action of opium, and even apes can take without injury doses of morphia which seem perfectly enormous when compared with the quantity which affects a human being. Where, however, opium is taken habitually, the human system becomes wonderfully tolerant of its influence, and the confirmed opium-eater will consume as his daily allowance a quantity sufficient to kill ten ordinary men. Even greater powers of endurance have been recorded in the annals of medicine, one of the best known instances being that of De Quincey, the "English Opium-eater," who at one period of his life was accustomed to consume 500, and on one or two occasions nearly 700 drops of laudanum daily, the ordinary medicinal dose for an adult being from fifteen to twenty-five drops.

In medicine opium is chiefly used in the form of a tincture, as in laudanum—a weaker preparation, combined with certain aromatic substances, being known as paregoric, or paregoric elixir. There is also a liquid extract of opium, and a wine of opium, each of which should contain a grain of opium to each twenty-five drops of the liquid. Opium forms an essential constituent of the compound soap pill, of Dover's powder, and of the aromatic powder of chalk and opium. For external application it is prepared in the forms of plaster and liniment, and it is sometimes used in ointment. In cases of neuralgia, lumbago, sciatica, and similar complaints, a mixture of equal parts of laudanum and opodeldoc rubbed over the affected parts will generally afford great relief, and a few drops of laudanum rubbed into the gums or applied on a morsel of cotton wool to a hollow tooth will often remove the pain of toothache. The ointment of galls and opium, made by mixing 80 grains of finely powdered galls and 26 grains of powdered opium with an ounce of lard, is a very useful application for piles. Internally opium is administered in cases of colic, cholera, diarrhoea, in some forms of cough, fever, and inflammation, and to relieve severe and prolonged pain of any kind. It is in the latter respect that opium exerts its most benign influence, and it is its power to mitigate human suffering that entitles it to be regarded as "the gift of God," a name by which it is known in the East. Under ordinary circumstances there is hardly any pain that will not yield to its influence, but for obvious reasons it should never be resorted to except in extreme cases. The method most in favour for its administration as a narcotic at the present day is by the hypodermic injection of morphia, for an account of which see under **HYPODERMIC INJECTION**.

In addition to its medicinal use opium is largely consumed in different parts of the world on account of its stimulating or narcotic powers. Indeed the quantity used for the latter purposes far exceeds that which is consumed in medicine. In Turkey, Egypt, Persia, and other Eastern nations, where the use of wine is prohibited by the established religions, opium is mixed with rich syrups and the juice of fruits, or is made up with spices into small lozenges. In India large quantities are eaten, and the practice is one of very old standing. An idea of its extent may be gained from the fact that the mere license fees for one year amounted to nearly £500,000. In China the opium is chiefly smoked, and most of the Indian opium finds its way there on account of its superior adaptability for this process. The actual amount of Indian opium imported into China represents less than a third of the quantity consumed by the Chinese; but all the latter who can afford it use the Indian drug, which bears a similar relation to the Chinese article that champagne does to vin-ordinaire. In western countries opium is usually consumed in the form of laudanum, and there is some reason to believe that both

in Europe and America the practice of opium-eating is on the increase. It is a well-known fact that the quantity of opium imported into this country and consumed there, is far in excess of that required for medical purposes, and a similar state of things is observed in the United States, in France, and elsewhere. In cases where persons are exposed to malarial influences or are suffering from chronic and painful disease, the habitual use of opium in small quantities seems to be beneficial rather than otherwise; but in the majority of cases where the drug is taken for its stimulating or soothing effects, its influence is of a very disastrous character. The habit assumes a tyranny almost impossible to resist, the amount required to produce physiological action has to be continually advanced, the bodily secretions are diminished, the bowels become obstinately constipated, appetite is diminished, and a few years of gradually increasing weakness are brought to a close by a premature death. Opium smoking appears to be far less injurious than the practice of opium eating, and though there is at present a conflict of testimony upon the point, the opinion of many medical men of extensive Eastern experience is that the practice is comparatively harmless. Dr. Ayres, the inspector of the Hong Kong hospitals, in a recently published work asserts, in reference to opium smoking: "My experience of it is that it may become a habit, but that the habit is not necessarily an increasing one. I think the excessive opium smoker is in a greater minority than the excessive spirit drinker or tobacco smoker. In my experience the habit in moderation does no physical harm." In the works of some recent travellers also, the habit of opium smoking has been compared with that of drinking wine in western countries; and while it is admitted that excess is not unknown, it is asserted that the result is far less injurious than that which follows inordinate indulgence in alcohol. As with alcohol and tobacco, it is found that active exercise or hard work in the open air tend to minimize the effect of the drug, persons of sedentary habits being most susceptible to its influence and most easily led into excess. On the other hand it is incontestable that opium smoking is often persisted in until it produces the most injurious results, the effect in bad cases being loss of appetite, great emaciation, listlessness, sloth, and moral and social ruin. For a long period the Chinese government resisted the introduction of Indian opium into China; but the enormous value of the trade caused the efforts of the Chinese ministers to be evaded or openly disobeyed, and the disputes thus caused led at last to open war, which was closed by the treaty of Nankin in 1842. For some years after this the Chinese emperor refused to allow any revenue to be derived from the opium trade; but after the close of the second foreign war, which terminated in the treaties of Tientsin and Peking, there was a change of policy on the part of the Chinese court; and an import duty was laid on the drug, amounting to about £10 a chest. In addition to this import duty further charges were made every time the opium passed the barriers of a province, the internal duties being levied by the officials in the most arbitrary manner. Of the sums thus charged, however, but a small portion reached the imperial exchequer, owing to the corruption rife in Chinese officialdom, while they greatly impeded and harassed the trade. These circumstances led to the opening up of negotiations between the British and Chinese governments, which resulted in July, 1885, in a modification of the Chefoo Agreement of 1876, by which the latter was permitted to impose an import duty of 110 taels per chest instead of 30, all internal charges being at the same time remitted. The importance of this treaty will be understood from the fact that the revenue derived by the Indian government from opium averages £9,300,000 per annum, more than three-fourths of which is obtained from the Chinese. The quantity of opium im-

ported into Great Britain has of late years averaged about 800,000 lbs., the exports being about half that quantity.

OPODELDOC, a term originally invented by Minderus or Paracelsus, and applied to a plaster designed to cure external bruises, but now used to designate the SOAP LINIMENT of the British Pharmacopæia. It may be made according to the following formula:—Hard soap (cut small), $2\frac{1}{2}$ oz.; camphor, $1\frac{1}{2}$ oz.; English oil of rosemary, 3 drachms; rectified spirit, 18 oz.; distilled water, 2 oz.; mix the water and spirit, add the other ingredients, digest at a temperature not exceeding 70° Fahr., agitating occasionally for seven days, and filter. It is slightly stimulating in its effects, and its lubricating properties enable an affected part to be well rubbed without unpleasant friction. It is a popular remedy in rheumatism, local pains, swellings, bruises, sprains, &c. *Arnica opodeldoc* is made by dissolving by heat and straining four parts of white soap, ten of rectified spirit, five of tincture of arnica, and one of camphor.

OPOPANAX is a genus of plants belonging to the order UMBELLIFERÆ. *Opopanax Chironum* is a native of the south of Europe and Asia Minor, on dry hills, margins of fields, and thickets. It is a plant 6 or 7 feet high, of a dull yellowish colour, and resembling a parsnip. The resinous gum which exudes from the stalk or root when wounded is brought from the Levant in roundish drops of a reddish-yellow colour, with specks of white. Its constituents are resin, gum, and volatile oil. In its action on the human system it corresponds with the other gum-resins of the Umbelliferae. This gum-resin is also called *Opopanax*.

OPORTO (*O Porto*, the port), the second city in Portugal in rank and commercial importance, is situated on the declivity of a hill on the right bank and about 2 miles from the mouth of the Douro, about 160 miles north from Lisbon, and has about 110,000 inhabitants, including the population of the suburbs of Villanova and Gaya, the ancient *Porto Cale*, whence "Portugal" is derived. Seen from the river the city presents a very striking appearance. The houses being all white-washed give it an air of great cleanliness, but on a closer inspection many of the streets are found to be narrow, crooked, and dirty, and some of them are very steep. It contains, however, several broad, straight streets, with a number of new and handsome houses, having gardens attached to them filled with vines and orange trees.

The river affords a deep and secure harbour, without any artificial aid except an elevated and walled quay, to which the ships' cables are fastened during the freshes or floods in the Douro. These freshes often cause a sudden rise of 40 feet, and come down with such force that vessels trusting to their anchorage alone would inevitably be carried out to sea. The mouth of the Douro is obstructed by a bar, which is seldom passable for vessels that draw more than 16 feet water. The quay extends the whole length of the town, or more than 2 miles.

Oporto has fine public squares, which are lined with trees and refreshed with fountains, and in which are some of the most important public buildings, numerous churches, and a fine and spacious cathedral. The immense lodges or wine cellars in the town and neighbourhood are deserving of especial notice. The principal merchants have their stores at Villanova, on the opposite side of the river, where 80,000 pipes are usually stored. The city gives title to a bishop, who resides chiefly at Mezanfrio, but has a fine palace in Oporto. The theatre, built in the highest part of the town, is much admired. Among the most conspicuous of the other public buildings are the general hospital, town-hall, English factory (one of the finest edifices in Oporto, built of white granite, with a beautiful façade, and comprising on a grand scale all the appurtenances of a club-house), exchange, mint, barracks, Italian

opera-house, and the suspension bridge across the river, formerly a bridge of boats. Many of the public fountains are ornamented with arabesque carvings. The city had formerly numerous convents, but many of these were destroyed during its siege by the troops of Don Pedro in 1832, and others have been appropriated to secular purposes. Oporto has also a medical college and other superior schools, a foundling hospital, a public library, gallery of paintings, commercial association, &c. Between twenty and thirty English mercantile firms are established here, which have large warehouses along the banks of the river, and by whom most of the foreign trade is carried on. The shortest sea route to Southampton is 730 miles.

The principal trade of Oporto is in port wine, which takes its distinctive name from the town. Next to Great Britain, Brazil and Russia are the countries to which the largest supplies of wine are sent. Corks, raw silks, fruits, oil, onions, sardines, cattle, salt, lime, pork, and preserved fruits are also exported. The imports are cotton, woollen, iron, and hardware manufactures; salt fish, hemp and flax, sugar, coffee, deals, coal, drugs, &c.

Oporto is the chief industrial city in Portugal, and contains numerous cotton spinning mills, silk factories, extensive manufactures of cotton goods, shawls, hats, leather, furniture, earthenware, sugar, tobacco, and soap; ship-building yards and iron foundries.

Oporto was occasionally the residence of the ancient earls of Portugal, till Alphonso I., in 1174, wrested Lisbon from the Almoraves, and made it the permanent capital of his kingdom. The city received many important privileges from John II. at the close of the fifteenth century; but most of them were withdrawn, in consequence of an insurrection of its inhabitants, in 1757. In 1805 it was taken and sacked by the French, who retained it till 1809, when the British crossed the Douro and compelled them to retreat. It afterwards became, in 1831-32, the scene of an obstinate and long-protracted conflict between Don Pedro and his brother Miguel. The siege of Oporto lasted upwards of a year, during which a considerable portion of the town was battered down by Don Pedro's artillery, a great deal of property was wantonly destroyed by Miguel's troops, many of the wine stores were blown up, and several of the wealthiest merchants were ruined by the annihilation of all trade.

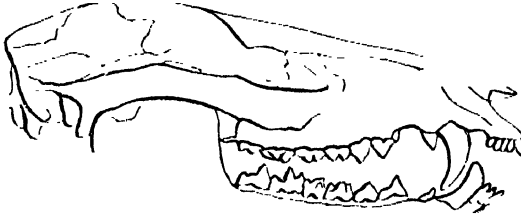
OPOSUM (*Didelphidae*) is a family of *MARSUPIALIA*, remarkable for being the only marsupials found beyond the limits of the Australian region. The opossums at the present day are confined to the American continent, extending from Texas to Buenos Ayres, being most abundant in the forest region of Brazil. Many species of small opossums, however, inhabited Europe in the tertiary age, their remains being found in strata from the Upper Miocene to the Upper Eocene.

The opossums are small animals, seldom exceeding the size of a cat, while others much resemble rats and shrews. In some species the marsupial pouch is well developed, but in others it is rudimentary or entirely absent: in the latter case the young opossums are carried on the back of their mother, twining their tails round hers. The tail is usually of considerable length and nearly naked, except at the root; it is strongly prehensile. The body is rather stout and well clothed with fur. The muzzle is long, pointed, and naked at the extremity; the ears are large, rounded, and almost naked. The feet on both limbs have five toes, but the first of the hind foot (hallux) is opposable and nailless; the feet are plantigrade and naked beneath. The opossums are remarkable for the number of their teeth, which are arranged as follows:—

$$I. \begin{smallmatrix} 5-5 \\ 4-4 \end{smallmatrix}; c. \begin{smallmatrix} 1-1 \\ 1-1 \end{smallmatrix}; pm. \begin{smallmatrix} 3-3 \\ 3-3 \end{smallmatrix}; m. \begin{smallmatrix} 4-4 \\ 4-4 \end{smallmatrix} = 50.$$

The true opossums (*Didelphys*) are nocturnal in their

habits, living for the most part in trees, amidst the foliage of which they hide themselves during the day, and sally forth at night in search of their prey, which consists of small mammals and reptiles, birds and their eggs, insects, and even fruit. The Common Opossum (*Didelphys virginiana*), the first marsupial known to science, is widely distributed throughout the United States. It is about the size of a cat, the body measuring 20 inches, and the tail another 15. The body is stout, clothed with long soft



Skull of Opossum (*Didelphys virginiana*).

woolly fur, with which are interspersed longer coarse white hairs. The fur of the body is dusky-brown, that of the face being lighter; the ears are black, the limbs and the root of the tail brownish-black. The opossum is omnivorous, but is destructive to poultry and birds, and very fond of birds' eggs. It is very tenacious of life, and is such an adept in the art of feigning death when surprised by its enemies that "playing possum" has passed into a proverb. A nest is made of dried grass under a bush or root of a tree. The female is very prolific, bringing forth from twelve to sixteen young at a time, and having several broods in the year. The young, when born, are very minute, blind, naked, and shapeless. When they have attained the size of a mouse they leave the pouch, returning to it to suck or at the approach of danger. The opossum is easily domesticated, but the skin emits an unpleasant odour. The flesh is edible. The common opossum is replaced in Mexico, Texas, and the south of California by *Didelphys californica*, a similar but smaller animal. The Crab-eating Opossum (*Didelphys cancrivora*) is a native of Brazil and Guiana, inhabiting swampy districts and feeding on the crabs which abound there; it also feeds on small birds, insects, and reptiles. There are some tropical opossums which have a short close fur and no marsupial pouch. These have been placed in a subgenus, *Metachinus*. The species are rather numerous. Among them may be mentioned Lord Derby's Opossum (*Didelphys derbiana*). Another subgenus has been established for two or three species of small shrew-like opossums, in which the tail, though long, is not prehensile.

The YAROCK (*Chironectes variegatus*) is an opossum adapted for aquatic life.

OP'PIAN, the name given to the author of three Greek poems on fishing, hunting, and fowling, the first and second of which, entitled "Halieutica" and "Cynegetica," are extant as poems, the third, on fowling, entitled "Ixeutica," being only known through a prose epitome. According to an anonymous biographer, Oppian flourished during the reign of Severus, and his poetical gifts enabled him to obtain his father's recall from banishment as well as a rich reward from that ruler. He died young, and was honoured by an epitaph which celebrated his precocious genius, which has been preserved. From internal evidence the two poems are assigned by modern critics to different authors, the "Halieutica" having been composed during the reign of Marcus Aurelius, probably between 177-180 A.D., and the "Cynegetica" after the death of Severus, 211 A.D. Both poems are in hexameter verse, the earliest

being much the better of the two. The principal modern editions of the poems are those by Schneider (Strasbourg, 1776) and by Lehrs (Paris, 1846, along with the Bucolic poets).

OPPOSITION, in astronomy, is a term used with relation to any one of the superior planets (superior planets being those which lie further from the sun than the earth), when it is so placed that the line from its centre to the centre of the sun has to pass through the centre of the earth. At this moment, therefore, the sun and the planet are exactly in opposite directions as viewed from the earth, whence the term.

OPS was the consort of the god SATURNUS in the ancient native Latin Pantheon; and when Saturnus became confused with the Greek Kronos, Ops naturally took the characters of Rhea or Kubele. In reality scarcely any goddesses could be more unlike. Ops was rightly, as her name implies (plural, *opes*, wealth), the goddess of plenty and prosperity, an appropriate wife for Saturnus, the god of the sown field. At Rome she shared one of the temples of Ceres, but her worship was chiefly among country folk, who adored her by touching the ground, her chosen dwelling-place.

OPTIC NERVE. See EYE.

OPTICS. See LIGHT.

OPTIONS, on the stock exchanges, are bargains in which the dealer may buy or sell a certain amount of stock at a certain specified price during a specified time. The consideration paid for the privilege of buying is called "giving for the call," and that paid for the selling-option is called "giving for the put;" sometimes options are "given for the *put and call*," when the dealer may buy or sell as he pleases. Sometimes stock is bought on condition that there is an option of buying an equal amount before settling day, "buying £5000 with the *call of more*," as it is called; and similarly £5000 may be sold "with the *put of more*."

The benefit of options is the limitation of loss on the part of the operator to the money paid for the option. Let the option be "for the *call*," i.e. for the privilege to buy anywhere during a fortnight at a certain price a certain stock to a certain amount, and let 1 per cent. be paid for it. Then if the stock rises the dealer claims his right, and gains all the rise over 1 per cent.; if the stock falls he loses only 1 per cent., and no more. If it rises 1 per cent. and remains stationary, he would probably sell an amount equal to that of the option, and so neither gain nor lose. But in any case he cannot lose more than the 1 per cent. Options are occasionally given on other markets as well as the money market.

OPUN'TIA. See PRICKLY PEAR.

OPUS RETICULATUM ("net-like work"), a style of building peculiar to Roman architecture. Pyramidal or wedge-shaped tiles with a square base were driven into plaster, so that the bases, close set together, formed a continuous face of a diamond-shaped network. The angles and string-courses were of heavy stone. *Opus spicatum*, another Roman variety, was made of long flat tiles, placed with their edges outwards to make the face of the wall, and laid slantwise, one row slanting to the right and the next to the left, &c. The style is also called "herring-bone masonry."

OR'ACLE (from the Lat. *oraculum*, and that from *os*, *or-is*, a mouth). Oracle was the Roman name used to denote the place where answers were supposed to be given by any of the divinities to those who consulted them respecting the future. Sometimes also it was used to signify the response which was delivered, and sometimes the deity from whom this response was imagined to proceed. The most famous oracles of antiquity were those of Zeus at Dodona and Apollo at DELPHI. The oracle of

Delphi plays a great part in Grecian mythology and history. It was a central point for all the nations of Greek origin who came to consult the god Apollo and left their offerings at his temple. Foreign princes also, as Cræsus (Kroisos), king of Lydia, sent presents to the temple of Delphi, which was enriched by the piety of many successive generations. Being a place of inviolable sanctity, it was also used as a safe depository for gold and silver. It was generally consulted in the month of *Iysios* or April, and once a day on other months—the answer of the god being communicated to the worshipper by a priestess, called the *Puthiu* (Pythoress). After the Roman conquest of Greece the oracle of Delphi fell into comparative neglect, for political circumstances diminished its influence, and the faith of the people had departed. In fact the oracle had lost much of its authority long before on account of its invariably favouring the Dorian party in politics. Delphi was in the hands of a hereditary Dorian clique, and these worked the oracle so unfairly against the Athenians that finally the trick became manifest and the words of the Pythoress were mocked at. The oracles were usually set forth in Ionic hexameters. At Delphi the priestess affected to inhale a vapour arising from a chasm in the rock; at Dodôna it was the sound of the wind among the trees that was listened to and professedly interpreted. Small cymbals were suspended in the trees, which clashed together as they stirred in the wind and made the oracle more manifest. Each shrine adopted its own method of divination. There were many other oracles to which the superstition of the ancient world ascribed a peculiar importance, as that of Amphiaraus, at Orôpos, in Attica; and that of Trophonios, at Sebasteia, in Bæotia. The two latter were supposed to be given by deified magicians or seers. But almost every nation had its favourite god, and each god its favourite oracle.

Oracles may be divided into five distinct classes:—(1) Enigmatical, which conveyed some old tradition in a popular form; (2) ambiguous, giving answers couched in such a form that the inquirer could easily wrest them to his own purposes; (3) extorted, that is, obtained by bribery or influence; (4) calculated, that is, based upon a calculation of probabilities, just as a politician may speculate beforehand on the result of an important division or voting; and (5) predictions fabricated after the event, and only attributed by the priesthood or interested persons to a particular god. The Greek oracles were on the decline before the introduction of Christianity, and lapsed in importance as the power and freedom of Greece went down before the martial civilization of Rome. Some of the ambiguous oracles are exceedingly clever. Thus to Cræsus it was said that when he passed the river Halus he should destroy a mighty empire, but it proved to be not the Persian Empire but his own that fell. So also Pyrrhus (Purrlon), king of Epeiros, was told, "You the Romans shall conquer," and him the Romans did conquer. He, however, had read the oracle the other way, or he would not have undertaken the expedition against the forces of Rome. It may be added that oracles never gained that favour with the practical Romans which they enjoyed among the imaginative Greeks. There were many oracles in Egypt of great authority. The most venerable was that of Zeus Ammon in the oasis of Libya.

ORAN', a fortified town of Algeria, the capital of a province of the same name, is situated on the Bay of Oran, 210 miles W.S.W. of Algiers. It stands on several hills, is pretty well built, and has an extensive trade in corn, cattle, wool, and leather, and considerable wine production. The port is not good, but 3 miles north-west is the port called Mers El Kebir. The town was built by the Moors driven from Spain, was several times captured by the Spaniards, and was destroyed by earthquake in 1791. The French took it in 1832. The population is about 40,000.

ORANGE, the ancient *Arausio*, an ill-built town, with 10,000 inhabitants, situated in the French department of Vaucluse, near the left bank of the Rhône, on a beautiful plain watered by the Aigue and several other small streams, at a distance of 12 miles north from Avignon. The town has some manufactures of printed cottons, handkerchiefs, serge, and silk; it has also a good trade in wine, brandy, oil, madder, saffron, honey, wool, corn, truffles, essences, &c. Orange abounds in Roman remains. A triumphal arch, commonly called the Arch of Marius, 60 feet high, consisting of a central arcade and two smaller lateral ones, separated by four Corinthian pillars, spans the highroad at the northern entrance to the town, and is justly dear to archaeologists for the beauty of its architecture and the rich sculptures of its illustrative bas-reliefs. The northern façade of the Roman theatre, which still stands in the centre of the town, and presents a gigantic rectangle 485 feet long and 115 feet high, is a most magnificent piece of masonry. It consists of five storeys, and is built of large uncemented stones. The basement storey has a grand entrance gateway in the centre supported by Corinthian pillars with capitals of white marble; on each side of the principal entrance are nine arcades separated by Doric pilasters. The third storey consists of twenty-one sunk arches of beautiful workmanship. The fifth storey presents a row of large projecting square stones, corresponding to a similar row at the top of the fourth storey, and pierced by holes intended to receive the poles which sustained the awning (*velaria*) that covered the spectators in the interior of the theatre. The interior has been cleared of rubbish and the huts that were built in it, and now presents a perfect view of the several parts of a Roman theatre, but deprived of all its ornaments. In the middle ages the town was the capital of a small independent principality, which came by marriage into the family of Nassau, afterwards stadtholders of the Netherlands, who took the title of Princes of Orange. This title the heir-apparent of the Netherlands still bears, but as to the principality, on the death of William III. of England (Prince of Orange), it fell to the King of Prussia, who exchanged it with France for other territories at the peace of Utrecht (1713).

ORANGE is the name of a tree and the fruit produced by the tree (*Citrus Aurantium*). It is nearly allied to the lemon, lime, citron, shaddock, all belonging to the same genus, *CITRUS*. There is a large number of varieties, the chief of which are the following:—

(1) The China Orange, with round, smooth, rather flattened fruit, and a thin golden yellow rind. This is the common orange of the markets and of the Portuguese.

(2) The Pear-shaped Orange, with great top-shaped fruit, with a deep yellow, smooth rind; a rare and curious sort not known in the market; it is one of the most capable of resisting cold.

(3) The Orange of Nice, with thick-skinned, rough, dark yellow, round fruit. This is considered one of the finest of the whole genus, both in regard to beauty, size, productiveness, and quality. It is a good deal cultivated about Nice.

(4) The Tiny-fruited Orange, with tiny globose fruit, and a thin, smooth, golden yellow rind. Supposed to have been brought from the Philippines. The fruit is more curious than beautiful or good.

(5) The Fingered Orange, with ovate fruit, some one at least of whose lobes is separate from the remainder, and horned; rind pretty thick. This must not be confounded with the Fingered Citron.

(6) The Blood-red Orange, with middle-sized, round, rough, reddish-yellow fruit, with a pulp irregularly mottled with crimson. This, which is said to have come from the Philippines, was once looked upon as a great curiosity, and plants were purchased at a considerable price. It was thought to be produced by grafting an orange upon a

pomegranate. Now that it is known to be a variety of indifferent quality, and that its fabulous history is forgotten, it has ceased to attract much notice.

(7) The Ribbed Orange, with a flattened, ribbed, deep orange fruit. This is one of the most tender of the varieties. Its fruit is spongy and of no value.

(8) The Sweet-skinned Orange, with roundish, rather ovate, heavy fruit, and a deep yellow, smooth, thick, sweet, soft rind. This is the Pomme d'Adam, or Forbidden Fruit, of the shops of Paris. Its pulp is subacid and pleasant, and of as deep a yellow as the rind, which is soft and melting like the flesh of a cling-stone peach; the acidity of the pulp is agreeably mixed with sweetness, and renders the fruit extremely pleasant. This is very different from the Forbidden Fruit of the London shops.

(9) The Saint Michael Orange, with small, round, pale yellow, seedless fruit, having a thin rind and an extremely sweet pulp. This, when in a state of perfection, is perhaps the most delicious of all the oranges, and it is by far the most productive. Great quantities are imported from the Azores, where it appears to be exclusively cultivated as an object of trade. It is said that 20,000 of these oranges have been picked from a single tree, exclusive of the large quantity which were blown down or rejected as unfit for sale. But in St. Michael itself the orange groves are being cut down, and spice-bearing trees planted instead.

Besides these, there are numerous other sorts to be found in the gardens of the curious, and in commerce there are many kinds about which little is known. Among these may be mentioned the *egg-oranges* of Malta, which are sometimes sent to England as presents; they are not, however, equal in quality to the China or the St. Michael varieties.

The BIGARADE and the BERGAMOT are considered by Sir J. Hooker ("Flora of British India") to be varieties of the common orange. A. De Candolle, in the "Origin of Cultivated Plants" (1885), thinks it probable that the native country of the bigarade, Seville, or bitter orange (see Plate), from which marmalade is made, was the eastern portion of India, and it is certainly reported as wild by Sir J. Hooker in the country south of the Himalayas from Garwal and Sikkin to Khasia. The Sanskrit name was Nagaranga; the Arabs, who used it medicinally in the tenth century, called the fruit Narunj, whence the English word. The sweet orange probably came originally from China and Cochin China, and spread over India, perhaps, towards the commencement of the Christian era. It was first cultivated in England in 1492. The mode of propagating it is by cuttings, grafting, layers, inarching, and seeds, but in our colder climate it seldom attains to any high degree of excellence. The oranges so abundant in our markets are chiefly brought from the Azores, Sicily, and Spain, a well-known Spanish species being the Seville; others are imported from Portugal and Italy. They are cultivated largely in Australia, Florida, California, and South America. The peel is largely employed in confectionery, and a favourite light wine is made from it, while the flowers yield the valuable perfume known as *néroly*, one of the chief ingredients in eau-de-Cologne. The flowers used for this purpose are those of the bigarade. From the leaves an essential oil called *petit-grain* is produced, and from the rind of the fruit another essence is expressed, which is styled "oil of bigarade." The largest bigarade-tree plantations are to be found in the south of France, in Calabria, and in Sicily.

ORANGE FREE STATE, a tract of country about 70,000 miles in extent, forming a plateau 5000 feet above the sea, separated from the Cape Colony by the Orange River, and bounded by British Basutoland and Natal on the east, the Transvaal on the north, and Transvaal and Griqualand West on the west. The state was originally occupied by Dutch Boers, but was declared an English colony

in 1818. It was, however, abandoned in 1854, and the inhabitants were allowed to form a government after their own wishes. The legislative authority is vested in a popular assembly, the Volksraad, and the executive in a president chosen for five years by universal suffrage, assisted by a council appointed by the Volksraad. The revenue is about £210,000 per annum. The republic has no debt. The principal export is wool, hides, and ostrich feathers, and considerable quantities of British produce are imported. The state is mainly a grazing country, the scarcity of water rendering much of it unfit for agriculture. Diamonds, garnets, and other precious stones are found in the drift deposits of some of the river beds, and there are rich coal mines. The country consists of undulating grassy plains, dotted here and there in the south-east with rocky hills or "kopjes." The capital is Bloemfontein. The population in 1880 was 133,518, about half of whom were whites of Dutch extraction and the remainder coloured.

ORANGE RIVER, THE, forms the northern boundary of the Cape Colony, and is the largest river in South Africa. Its course from its head waters in the Mahuti Mountains may be roughly estimated at 1200 miles, while the basin of its drainage cannot be less than 400,000 square miles, extending from near Lake Ngami, in lat. 21° S., to the Nieuwveld Mountains, in lat. 32°, and from lon. 16° 32' E., that of its mouth, to 30°. The mouth is barred with a sandbank. Inside this the river can be ascended in small craft from 20 to 30 miles, but the numerous dykes of rock crossing the river form fearful rapids, and bar any further progress; and, indeed, so dry and rainless are the regions it traverses in the lower part of its course that it appears a much finer river at Aliwal, or near Colesberg, many hundreds of miles from the sea, than near its mouth.

ORANGEMEN (*i.e.* followers of William of Orange, the Protestant rival of James II.), the designation taken by the members of an Irish society instituted in 1795 to maintain Protestant ascendancy in Ireland. The oppressed condition of the Roman Catholic population of Ireland had brought about at that period an intense feeling of hostility towards British rule, and the country was honeycombed with secret societies which had for their object the separation of the two countries, their efforts culminating in the unsuccessful rebellion of 1798. The suppression of the rebellion greatly strengthened the Orange society by identifying the religious antipathies of the Protestants with the cause of the maintenance of the Union, and a grand lodge of Ireland was founded at Dublin in November, 1798. In a few years the organization of the society was extended throughout the whole province of Ulster, and branches were formed in every Protestant centre in Ireland. In 1808 a grand lodge was formed at Manchester, and in 1821 it was transferred to London. The influence of the society, which had been declining for some years, was revived on the bringing forward of the subject of Catholic emancipation, and in 1827 the Duke of Cumberland accepted the grand-mastership for England. The following year the grand lodge for Ireland, which had been suppressed, was re-established, the Duke of Cumberland being elected imperial grand-master. Orange lodges were set up in the different regiments of the British army, and the organization of the society was extended to the British colonies. In 1836, according to parliamentary reports, the Orangemen numbered 145,000 members in England and 125,000 in Ireland, and it was conclusively proved that the association tended to keep alive a bitter feeling of sectarian animosity, to discredit justice, and to weaken the authority of the law. Its clubs were accordingly formally suppressed by Parliament, but were revived in 1846 when Sir Robert Peel proposed to endow the Roman Catholic College of Maynooth. Orange societies

still exist in Ulster and in Canada, but their power and influence have greatly declined during recent years.

OR'ANGERY, a gallery or corridor of glass and wood, or of glass and any other solid material, intended for the preservation of orange trees during the winter. Its roof must be opaque, and so should be its north side; its front must be of glass; and the height should not be less than 15 feet. Hot water or flues may be employed to heat it. The finest orangeries are those of Versailles in France, the Royal Gardens at Monza, and the Borghese Palace at Rome.

ORANG'-UTAN' (*Simia*) is a genus of anthropoid apes, confined to Sumatra and Borneo. The name orang-utan is of Malayan origin, and means "wild man of the woods;" the Dyaks of Borneo call this ape *Mias*.

The remarkable man-like apes of the great Indian islands appear to have been entirely unknown to the ancients, unless Pliny's mention of Indian satyrs refers to the orang-utan. It is not, indeed, until the middle of the seventeenth century, that we find any notice of these animals in the writings of Europeans. About this period the orang-utan is mentioned by Johnston in his "Historia Animalium," but described as brought from Angola. In 1658, however, some genuine observations upon the orang were published in Holland; their author, Bontius, a Dutch physician residing in Batavia, having seen "several of these satyrs of both sexes" in that country. Since then travellers and anatomists have added considerably to our knowledge of these apes; and Mr. Wallace, in his "Malay Archipelago," has given a very full account of their life and habits from personal observation. There seem to be only two species of orang utan. The largest (*Simia satyrus*) is the *Mias pappan* or *Mias chappan* of the natives, and is most abundant in Borneo. According to Wallace the size of this ape has been much exaggerated, as the largest adult males which he met with measured only 4 feet 2 inches from the crown of the head to the heel—the disproportion in length of the arms and legs, and the great muscular development of the body, giving an appearance of greater height than is really the case. The arms are very long, reaching nearly to the ground when the animal is in an erect posture; the body is covered with reddish hair, which is long on the limbs, and forms a short beard pendent from the chin; the face is naked, and, in the males, greatly expanded at the sides by two large fatty protuberances on the cheeks; the ears are small and rounded, and much resemble those of man in form; and the lips are very large, and capable of being protruded and retracted to a great extent. There is a remarkably large air-pouch, descending in front of the breast-bone, and communicating with the windpipe, from which it may be greatly inflated with air. This animal lives in the lofty primeval forests of Borneo and Sumatra, but only in the swampy districts, where the forest is unbroken, and the interlacing branches afford him a means of passing readily from tree to tree, without the labour of descending to the ground.

Mr. Wallace thus describes the peculiar method of progression adopted by the orang:—"He walks deliberately along some of the larger branches, in the semi-erect attitude which the great length of his arms and the shortness of his legs cause him naturally to assume; and the disproportion between these limbs is increased by his walking on his knuckles, not on the palm of the hand, as we should do. He seems always to choose those branches which intermingle with an adjoining tree, on approaching which he stretches out his long arms, and, seizing the opposing boughs, grasps them together with both hands, seems to try their strength, and then deliberately swings himself across to the next branch, on which he walks as before. He neither jumps nor springs, nor even appears to hurry himself, and yet manages to get along almost as quickly as a person can run through the forest beneath." The orang rarely descends to the ground except in dry weather

in search of water, of which it usually finds sufficient in the hollows of leaves.

When not disturbed, or in search of food, the orang appears to be sedentary in its habits. It sleeps every night on a nest made by breaking off the leafy branches of trees, and laying them over each other upon a forked horizontal branch, until it forms a bed so thick as to conceal it entirely from below; in rainy weather it is also said to cover itself in a similar manner with small branches and leaves, and to keep its bed till about nine o'clock, when the sun has become hot enough to disperse the mists. The nest is usually placed at about 20 or 30 feet from the ground. The orang is said never to return to the same tree for two consecutive nights. It seems to be solitary in its habits, for Mr. Wallace never saw two adult animals together.

The food of these apes consists almost entirely of fruits, supplemented by leaves and tender shoots. According to Mr. Wallace they seem to prefer unripe fruits, many of which are intensely bitter, but the delicious durian is an especial favourite. The oranges appear to have little fear of man, but will often stare down upon an intruder for a few minutes and then remove slowly to a short distance. When pursued, however, as they often are by the Dyaks, who kill them with poisoned arrows and eat their flesh, they manifest some alarm, and endeavour to get as quickly as possible into the loftiest tree in their neighbourhood, and throw down branches and fruit as if to intimidate their pursuers. When badly wounded, they make a nest similar to their ordinary nightly lair and lie down to die. According to the Dyaks the only enemies with which the orang has to contend are the crocodile and the python, both of which he is able to destroy.

The female produces only one young at a birth, and carries it about for a considerable time clinging to the long hair of her body. Several young orang utans have been exhibited in Europe, displaying in captivity as much gentleness and docility as the chimpanzee.

The second species of orang-utan (*Simia morio*) is precisely similar in its habits to the larger species, from which it is distinguished by the absence of the fatty excrescences on the cheeks, and the greater comparative size of the canines and other teeth in the males. The females seem to be chiefly distinguished by having the two middle incisor teeth in the upper jaw proportionately broader.

ORATORIO. The name of this, the highest form of musical expression, is due to an almost accidental circumstance. In the days when Shakspeare was a lad in England, the miracle plays and mystery-plays of the church and the trade guilds were the great source of the dramatic enjoyment of the people. They were often enacted in the churches themselves. Taking advantage of their great popularity, St. Philip Neri had them performed in his oratory at Rome, and between the scenes of the drama hymns were sung and little sermons preached. Drama, hymns, and sermons were chosen so as to make one tolerably harmonious whole; and the evenings at the Oratorio of Padre Filippo were highly popular, and probably did good in bringing many to a place of worship who otherwise would not have gone. This last, no doubt, was the design of the founder of this strange church service. The oratorio, as it came to be called, did not die with St. Philip. It passed from the hands of the priests into those of the musicians, and the same year which saw the opera arise from the Greek tragic drama greeted the oratorio on its development from the mystery-play. In the article OPERA an account is given of the production of Peri's "Euridice" at Florence, in 1600; and this very year, five years after the death of St. Philip Neri, the friends of Emilio del Cavaliere had produced at Rome, a few months previously, his oratorio "L'Anima ed il Corpo." Cavaliere died before the performance of his

oratorio. This was strictly a mystery-play in music, where "The World" and "The Body" come to grief, and "Time" and "The Soul" triumph over them, even with dances, at the close! Nevertheless it was truly, in the modern sense of the word, an oratorio, and excites our deepest interest, even in its very quaintnesses, as the germ of so much that is grand and noble.

For some time no one followed *Cavaliere*. In 1622, however, an oratorio on St. Ignatius Loyola and St. Francis Xavier was produced by the Jesuit College at Rome; and the model of *Cavaliere*, once revived, was not suffered again to languish. The next year (1623) saw the appearance of the first German oratorio, the "Resurrection," by Heinrich Schütz, which had many successors both from Schütz himself and from other Germans. Several Italian musicians turned their hand to the new style of sacred musical drama, especially Mazzocchi with the "Querimonia (lamentation) di S. Maria Maddalena," first heard at Rome about 1640, and still capable of moving our admiration by its pathetic and appropriate melody. But it was Giacomo Carissini (1582-1674), a native of Padua and an inhabitant of Rome, who raised oratorio almost to its present level. Many of his long list of oratorios have been studied in later days, and wholly or in part reproduced; notably "Jephthah" and "Jonah," which have not long since been carefully republished, and are occasionally to be heard in performance. It is difficult to excel the beauty of Carissini's recitatives; he seems to have struck almost the highest possible point of expression, and in this he was no doubt aided by the growing desire to keep down the strictly dramatic element of the oratorio. Deprived of the dress and bustle of the stage, the music had to be relied upon to provide the requisite intensity of passion, and to counterbalance the loss in interest by providing a nobler substitute.

Alessandro Scarlatti of Naples (1659-1725) took up oratorio where Carissini had left it, and achieved as great triumphs in this as in all other branches of composition, endowing it with that settled form of air, in two contrasted parts and a "Da Capo," which music owes to his invention, and with many other excellences. Caldara and Colonna, and the excellent Neapolitan composer Leo, better known to us as one of the finest of madrigalists, were worthy contemporaries of Scarlatti in oratorio. Stiadella, another Neapolitan, wrote only one oratorio, but that is very beautiful, and indeed is said by its beauty to have saved its composer's life. [See STRADELLA.] Those who have been led to study "San Giovanni Battista" by curiosity, through the romantic legend referred to, have been rewarded by finding much beauty.

We have now arrived at the immortal Handel, who was to teach us of what sublime strains the art is capable. When a young man of only nineteen he wrote a really astonishing work in oratorio form, the St. John Passion, which came out at Hamburg in 1704, when a very fine work on the same subject by Keiser also appeared. Hamburg for the time was the centre of musical progress—leader in opera as well as oratorio. But when Handel left for Italy he abandoned the splendid gravity of the German style for the florid beauty of the Italian schools, and his oratorio of "La Resurrezione," written in Rome in 1708, though only four years later than the German Passion, cannot be recognized as due to the same hand. In 1716 another German oratorio (again on the Passion) proceeded from Handel's pen, a magnificent work. The master now devoted himself to opera, and was deservedly held the greatest musician of his time. Oratorio, destined to be the scene of his later triumph, was carried forward chiefly by Mattheson, until the immortal John Sebastian Bach enriched the world for ever with his glorious trilogy of the lesser Passion (St. John's, 1720), the greater Passion (St. Matthew's, 1729), and the Christmas Oratorio (1734). In

these works the German chorale takes the place of the hymns in the original oratorio of St. Philip Neri, and thus the congregation is encouraged to join in the oratorio for itself. The unsurpassed richness of harmony with which Bach has adorned these interpolated chorales is something never to be forgotten when once heard. It is needless to speak of a work such as the Matthew Passion, which can be heard many times every year by all who choose, and which produces more effect upon the hearers now than when it was first written. At that time, indeed, probably Graun's oratorios, which were really fine works (though not comparable, of course, to the writings of Bach), were more generally known than those of the great master. Graun wrote Passion oratorios, the greatest of them being the famous "Tod Jesu" (1755), which well repays performance even to-day. There are an earnestness and gravity about his work which make him no contemptible rival of the mighty cantor of Leipzig, and a certain simplicity of style which has an appropriateness to the deepest feelings of religion that the wonderfully complex and elaborate scoring of Bach sometimes passes by. Bach can be as simple as anyone when he chooses, but he does not always choose.

The one master who combined the learning of Bach with the simplicity of Graun, whose learning was concealed beneath a mask of perfect ease, and whose simplicity was the result of the most consummate art, was Handel. The enormous pains taken by Handel to secure this effect of "breadth" and the complete subordination of details to easily recognized bold outlines, has rendered him unique in at least one particular, namely, that it is impossible to overweight his music by mass of sound. The larger the orchestra and chorus the more splendid are Handel's effects [see HANDEL FESTIVAL]: he bears with ease a weight that would completely crush any other composer. Handel, when he wrote his first English oratorio, "Esther," for the Duke of Chandos in 1720, was at the height of his powers. The oratorio was much admired, but remained long the duke's private property, and Handel had other work in hand to draw him away from sacred subjects. "Esther," however, became known, and unauthorized performances of it were given. At last Handel gave a full public performance of it at the King's Theatre in 1732, and its fame was at once assured. He was pressed for more in the same style, and "Deborah" was written the next year, wherein for the first time his power over the double chorus was displayed. Later on, in 1733, "Athaliah" was produced at Oxford. "Saul" and "Israel in Egypt" both appeared in 1739, the first the most intensely dramatic, the second the most sublimely representative, of the composer's works up to that time. Who that has heard the Witch Scene in "Saul," or the Dead March, requires any scenery or stage effect to realize the grandly dramatic effort? Who that has heard the Hailstone Chorus, "He sent a thick darkness," or "The horse and his rider," has not been silent with awe at the musician's power of painting mental visions? Both these stupendous efforts were eclipsed by the immortal "Messiah," the most supreme effort of religious music, which was first produced in Dublin, 13th April, 1742. The charm of this unrivalled work blinds one at first to the colossal efforts of skill which it contains. Probably the "Amen" chorus is the nearest approach to a model vocal figure that has ever been written, and the simplicity of the "Hallelujah" chorus is but on the surface, in reality it is a marvelously ingenious piece of counterpoint. No one in rising to hear the "Hallelujah" chorus (an honour paid to that and to the National Anthem alone), ever thinks of counterpoint or of any artifice. It seems like a spontaneous outburst of joyful reverence for the Father of heaven, and only the musical student can remain cool enough to analyze the strokes of the brush which have painted this blaze of overwhelming glory. "Samson"

(1743), "Joseph" (1744), "Belshazzar" (1745), the "Occasional Oratorio" (1746), "Judas Maccabeus" (1747), "Alexander Balus" and "Joshua" (1748), "Susannah" and "Solomon" (1749), and "Theodora" (1750), came from the wondrous brain of the composer with phenomenal rapidity. Some of these are now to be heard from time to time (all of them ought to be), but even of those which are rarely produced the finest airs and choruses are always before us, the perennial delight of our concert rooms. It is curious that "Theodora," now never performed as a whole, was considered by Handel as his finest work. Finally, in 1752, when he was very nearly blind, Handel with great labour finished his last oratorio, "Jephthah," the recitative and air of which, "Deeper and deeper still," and "Waft her, angels," stand yet to Englishmen as they have for much more than a century stood, as the sublime of pathos in music. Handel died in 1759, his last public appearance being to direct the "Messiah" at Covent Garden only a week before his death.

The immense superiority of Handel to any other oratorio composer crushes down his contemporaries almost into oblivion, yet Arne in England ventured after Handel's death to write "Judith" (1764), and Hasse in Dresden enjoyed a great reputation for oratorio for many years. He had been invited to London as a rival to Handel, but with the pride of a true artist declined the engagement. Arne is noticeable as the first to use female chorus singers: Handel had always employed boys in his choruses. No other writers claim notice in a general sketch like the present until Haydn, who took up oratorio in 1774 with his "Tobias," but like Handel passed from it to other branches of composition. A visit to England incited him to follow the grand footsteps of Handel. He was proud of his great reputation in England, and gave us of his best. His "Creation" (1798) has always stood next in our affections to the works of Handel. Haydn's other oratorio, the "Seasons" (1801), still also holds its place in our concert rooms. As Handel out-blazes all the lesser lights of his day, so does Haydn those of his day; good men wrote in various lands, but at so great a distance beneath Haydn that they may here be passed by.

Beethoven, in 1802, claimed the vacant throne with his "Mount of Olives," a sacred drama in the old mystery-play style, wherein Christ himself sings airs and joins in concerted pieces. This was tolerable enough three centuries before, but in the nineteenth century can no longer be borne with. A new text has been set, the subject being the trials of David, and the name "Engedi," but the error of the great musician is unpardonable in accepting an irreverent text, and with all its splendours the "Mount of Olives" is almost unheeded. The "Hallelujah" from it is well known to all, and is worthy of the mighty master. More fortunate was Spohr with his "Last Judgment" (1812), and his "Last Things" (1825), the latter oratorio being absurdly known in England by the title of the first ("Last Judgment"), but under whatever misnomer remaining one of the most favourite works we have. The chorus, "Blessed are the dead," is almost as much a feature of our funeral and memorial services as the Dead March in "Saul" itself. His third oratorio ("The Last Days of the Saviour") is often called "Calvary" in England, and sometimes "The Crucifixion," but is not often heard. It was written in 1835, and was followed eight years later by the "Fall of Babylon," produced in London for the Sacred Harmonic Society.

The year after Spohr's "Babylon" had profoundly moved London, there appeared at Liverpool the "St. Paul" of Mendelssohn (1836), and all men felt that at last there was an approach made to the level of Handel and Haydn. "Elijah" was written for the Birmingham Festival of 1846, and at once sprang into the first rank of the public favour, the "Messiah" alone holding rivalry with it. This is not

to say that Mendelssohn can be put, even by his admirers, on a level with the older writers, but rather, that being a worthy rival, he addresses us in our own speech with the idioms of to-day, while they speak to us with the tones of our forefathers. In "St. Paul" Mendelssohn follows the line of Bach, whom he greatly revered, and the introduced chorales in that work are very grandly harmonized, and of splendid effect. One of them, "Sleepers, wake," repeating an effect of Bach's with trumpet flourishes between the lines of the hymn, is certainly the most splendid piece of its kind that we have. But it is unnecessary to call attention to the merits of what every one knows or should know by heart. When Mendelssohn died he had in hand a third oratorio "Christus," but only sketches and small fragments of this exist.

Since Mendelssohn, we have had Costa's "Eli" (Birmingham, 1855) and "Naaman" (Birmingham, 1864), Sterndale Bennett's "Woman of Samaria" (Birmingham, 1867), Macfarren's "John the Baptist" (Bristol, 1873), "Resurrection" (Birmingham, 1876), and "Joseph" (Leeds, 1877), Benedict's "St. Cecilia" (Norwich, 1866), and "St. Peter" (Birmingham, 1870), Gounod's "Redemption" (Birmingham, 1882) and "Mors et Vita" (Birmingham, 1885), and Mackenzie's "Rose of Sharon" (Norwich, 1884), all works of real and undoubted excellence in oratorio; and every few years we have the pleasure of a fresh work in this grandest of all musical styles. As yet Handel, Bach, Haydn, Mendelssohn, and Spohr remain without compeers; but there is no finality in art, and none can tell what riches are yet in store for us, even though the imagination sinks before the task of conceiving of aught greater than these men have accomplished.

ORATORIO, a name signifying "place of prayer," originally applied to all places of Christian worship, but afterwards limited to private chapels attached to castles or dwelling-houses. Most of them were consecrated only for private and family prayer and other devotion, the celebration of the Eucharist not being permitted. In cases where the oratoria were consecrated for the celebration of mass, they were usually placed under the jurisdiction of the bishop of the diocese or of the parochial clergy, and the worshippers were expected to attend the parish church on the great festivals. At the Council of Trent some stringent rules were enacted for the regulation of oratoria, and the prevention of the jealousies and disputes to which their maintenance had so often given rise.

ORATORY. The matter of which oratory consists is language and expression. The language is the medium by which the meaning of the speaker is conveyed, which may be written or spoken. It is true that oratory properly implies spoken language; but it does not exclude the circumstance of the speech being first written; and indeed, it is probable that all the best speeches have been written before they were delivered. The orations of Cicero and Demosthenes, and many of modern times which have deserved celebrity, can now only be viewed as written compositions, though, in forming our estimate of them, we must judge of them with reference to their matter and object, and consequently with reference to delivery.

So far as concerns the matter and the language, an oration or speech must be judged of, like any other composition, with reference to its purpose, and the adaptation of it to such purpose. Accordingly there are various kinds of speeches or oratory adapted to various circumstances, to public deliberative assemblies, to courts of justice, to the pulpit, and so forth. The art of oratory, in so far as it may be reduced to rules, is embodied in the treatises on *Rhetoric*, and also to a considerable extent has to do with *Logic*; but after all, the highest flights of oratory, like the highest consummation of any fine art whatever, are not teachable nor reducible to rule. A certain reasonable level may be gained, and is well worth

the gaining, but the power of a Bright or a Gladstone over a hushed assembly is due to the workings of a genius poetic in its scope, acting through incomparable natural media. The throat and lungs of the born orator must be as perfect as those of a great singer, and upon this magnificent instrument he plays with the skill of unmatched minstrels.

Elocution is that pronunciation which is given to words when they are arranged into sentences and form discourse. It includes the tones of voice, the utterance, and enunciation of the speaker, with the proper accompaniments of countenance and gesture. The art of elocution therefore may be defined to be that system of rules which teaches us to pronounce written or extemporaneous composition with justness, energy, variety, and ease; and agreeably to this definition, good reading or speaking may be considered as that species of delivery which not only expresses the sense of the words so as to be merely understood, but at the same time gives them all the force, beauty, and variety of which they are susceptible.

ORATORY, CONGREGATION OF THE, a congregation of ecclesiastics living in community, but not bound by any special vow. Several such societies have been established in Italy, the Low Countries, France, and elsewhere; but the most famous was that founded at Rome by St. Philip Neri, early in the sixteenth century, and to which, at different times, have belonged Baronius the eminent historian, the learned Galland, and the persevering archaeologists Bosio and Severani. The Congregation of the Oratory at Paris was established by the Cardinal Pierre de Bérulle in 1611, and produced, among other celebrities, Malebranche the philosopher, and Massillon the great preacher. In 1817 this congregation was introduced into England by Dr. J. Henry (afterwards Cardinal) Newman, and two branches of it are now extant—one at Birmingham, and one at Brompton, in London. Besides the duties of the pulpit and the confessional, public service and private devotion, extended theological studies occupy the members of these societies.

ORB, ORBIT. The Latin word *orbis* signifies the circumference of a circle or of any round body, and "orbs" among the ancient astronomers meant the vast rotating crystal spheres in which the heavenly bodies were supposed to be placed, and fixed upon which they revolved; hence orb came to be used for a sphere, as when the sun is called the *orb of day*. The word orbit now means the nearly circular path in which a planet travels round the sun or a satellite round its primary. It is also applied by analogy to the long ellipses in which comets move.

ORBIL'US PUPIL'US (158-63 B.C.) was the schoolmaster of Horace, a stern pedagogue, trusting to the birch as much as to his books for the purpose of imparting education. His name has passed into a proverb.

ORCA'GNA, ANDREA (1329-76), whose real name was Andrea di Cione, soon gained the surname of *L'Arcagnuolo* (the archangel) for the wonderful imagination and power of his painting. Orcagna is the corrupted form of this surname. He was, like so many other famous Florentine artists, apprenticed to a goldsmith, and was a skilled worker in metals, and a good architect as well. He is even finer as a sculptor than as a painter, but in both these arts he is a follower of Giotto. Some have said he was a pupil, but this has been proved erroneous. His principal painting is the "Heaven and Hell" in Santa Maria Novella at Florence; but the famous Campo Santo pictures, long attributed to him, are now known to be by other painters. The National Gallery possesses a fine work in twelve panels on the "Coronation of the Virgin," &c., painted as an altar-piece for S. Pietro Maggiore at Florence. Orcagna combined the delicacy of the Siennese school with the force of the Florentine, and was undoubtedly the immediate guide of the fifteenth-century schools.

The sculptures of Orcagna are very remarkable. The finest are those decorating the tabernacle in the Church of San Michele in Florence, which, regarded as architectural embellishments, perhaps err on the side of over-richness, if that is possible. Orcagna was very great at bas-relief, and was the first to introduce into it the pictorial element, afterwards so magnificently treated by Pisano and Ghiberti.

ORCHARD (Anglo-Saxon *ortgeard*, i.e. *wort-gard*, a garden for wort or vegetables), a piece of ground specially devoted to the cultivation of hardy fruit trees. Apples, pears, and cherries are the fruits principally cultivated in orchards in Great Britain, but the term is also used to signify inclosures in which filberts, walnuts, plums, medlars, quinces, &c., are grown. In Southern Europe fig and peach orchards are very common, as are also inclosures of land set apart for the growth of oranges and lemons. The principal orchards of England are those of Devonshire, Somersetshire, Gloucestershire, Herefordshire, and Worcestershire for apples and pears, and those of Buckinghamshire and Kent for cherries. From the latter county a large supply of fruit is sent to the London markets, the apples and pears grown in the south-western counties being used chiefly in the manufacture of cider and perry. During recent years the attention of landowners and gardeners has been frequently called to the subject of fruit culture, and there seems to be a disposition in many places to set apart more land for this purpose, the produce being either sent fresh to the large towns, or utilized for the making of jams and preserves.

Orchards of apples and pears are more numerous, because more productive on the old and new red sandstone formations than on any other strata; a very large proportion of all the cider and perry that is manufactured is grown upon these soils. It is found that apple trees thrive best in ground that abounds in clays and marls, while the pear will flourish and produce heavy crops of fruit in ground of a dry, light, and sandy character. Some orchards are formed in old pastures, the grass being eaten down by cattle and sheep, care being taken to prevent the trees being injured. In general, a situation should be selected in which the trees will be sheltered from the north and north-west winds, and the rows of trees should be arranged so as to secure for them the greatest benefit from the sun. Very open and exposed situations are unsuited to the production of fruit, and low damp valleys are equally unfavourable, the trees in the one instance being liable to be injured by the wind, and in the other by the prevalence of fog and damp. Where there is too much moisture the trees become covered with lichens and mosses, and fail to produce their fruit. A favourite form of orchard is that in which *decursif standard* trees are planted in rows about 12 feet apart, the intervening spaces being utilized for the growth of gooseberries, currants, and raspberries. In these the ground should be regularly dug and supplied with manure. Where larger trees are planted these should be set at a distance of from 40 to 60 feet apart, and in planting the roots should be encouraged to extend near the surface rather than to penetrate deeply into the ground.

ORCHARD-HOUSE, the name given to a structure first designed by Mr. Rivers (died 1877), whose pamphlet, entitled "The Orchard House," is the standard work on the subject. It is composed chiefly of glass, and it may be either erected against a wall, from which it slopes outwards or downwards, or it may consist of an elegant movable structure with iron supports and a double sloping roof. The trees, whether peaches, nectarines, plums, pears, &c., are all grown in pots provided with a large hole in the bottom, through which roots may pass into a properly prepared substratum during the spring and summer. After the fruit is gathered the roots are cut through at the bottom of the pot and the trees are set aside for the winter's rest,

this treatment being repeated from year to year. In this way a large quantity of fine fruit may be grown in a limited space, and a long succession of crops may be maintained if the earliest and latest kinds are kept under cultivation.

ORCHESTRA, a Greek word (its origin being *orchesthai*, to dance), the name of the part of a Greek theatre set apart for the chorus, and in which the choral dances were performed. [See Plate V. in GREEK ARCHITECTURE, where the orchestra is seen, of a somewhat hemispherical shape, just in front of the proscenium or acting stage.] The article GREEK DRAMA gives a full account of the uses of the orchestra and the function of the chorus.

The Modern Orchestra.—When opera grew up out of attempted revivals of Greek tragic drama in the Renaissance era closing the middle ages, and the band which accompanied the actors was brought from its original place behind the scene to a position in front of the stage, its similarity both of position and of function (as supporter of the actors) to the old Greek chorus, suggested the revival of the term orchestra, though the shape of this space was now a narrow oblong. The band itself, playing in an orchestra, came also to be called "orchestra" in time, following a confirmed habit of the human mind. When instrumental music began to take independent rank, the shape of the orchestra built for it in concert rooms returned to the original semicircular plan, the leader being placed at the centre of the chord of the arc, where he is easily visible by all, and the floor of the orchestra rising by concentric steps like the seats of a Greek theatre. The vast orchestra at the Crystal Palace, used for the Handel Festivals, &c., seats between 4000 and 5000 performers, instrumental and vocal.

The composition of a modern instrumental orchestra or band varies with its purpose. In theatres, to play simple interludes between the acts, &c., an orchestra of fifteen to twenty five is found ample; but at the opera or in the concert room it is impossible to produce the many varied effects of modern music with less than seventy or eighty performers. In the article INSTRUMENTATION the various components of an orchestra are described, and it is evident that with a wood wind of at least eight, and brass wind (including two pairs of horns) of probably ten, together with drums, &c., forty or fifty stringed instruments are not too many to preserve the due balance of tone. Extra instruments, such as the harp, the tuba, the euphonium, the contra-fagotto, the piccolo, &c., must also be added.

ORCHESTRATION. See INSTRUMENTATION.

ORCHIDÆ (from *Orchis*, one of the genera) is an order of plants belonging to the MONOCOTYLEDONS. In consequence of the singular forms, the gay colours, and the delicious fragrance of many of these plants, they have of late years been cultivated with great zeal, both in this country and abroad. Orchidaceous plants inhabit all parts of the world, except those which are excessively dry or excessively cold, both of which appear uncongential to their nature, and they are most abundant in such as have an equable mild climate, moist and warm during the greater part of the year. Thus, we have not a single species from Melville Island or Nova Zembla, nor from the upper regions of northern mountains, nor from the deserts of Africa; and the whole province of Mendoza, one of the dry western states of South America, produces but one, and that in a marsh. On the contrary, the woods of Brazil and equatorial America, of the lower ranges of the Himalayas, and of the Indian Archipelago, possess countless myriads of these productions. "Here they are almost omnipresent in some of their countless forms. They grow on the stems, in the forks, or on branches of trees; they abound on fallen trunks they spread over rocks, or hang down the face of precipices, while some, like our northern species, grow on the ground among grass and herbage. Some trees whose bark is especially well adapted for their support are crowded with them, and these form natural orchid gardens. Some

orchids are particularly fond of the decaying leaf-stalks of palms or of tree-ferns. Some grow best over water, others must be elevated on lofty trees and well exposed to sun and air. The wonderful variety in form, structure, and colour of the flowers of orchids is well known; but even our finest collections give an inadequate idea of the numbers of these plants that exist in the tropics, because a large proportion of them have quite inconspicuous flowers, and are not worth cultivation. More than thirty years ago the number of known orchids was estimated by Dr. Lindley at 3000 species, and it is not improbable that they may now be nearly doubled. But whatever may be the number of the collected and described orchids, those that remain to be discovered must be enormous. Unlike ferns, the species have a very limited range, and it would require the systematic work of a good botanical collector during several years to exhaust any productive district—say such an island as Java—of its orchids. It is not therefore at all improbable that this remarkable group may ultimately prove to be the most numerous in species of the families of flowering plants.

"Although there is a peculiarity of habit that enables one soon to detect an orchidaceous plant, even when not in flower, yet they vary greatly in size and aspect. Some are small creeping species, are hardly larger than mosses, while the large Grammotophyllums of Borneo, which grow in the forks of trees, form a mass of leafy stems 10 feet long, and some of the terrestrial species—as the American *Seberalia*—grow erect to an equal height. The fleshy aerial roots of most species give them a very peculiar aspect, as they often grow to a great length in the open air, spread over the surface of rocks, or attach themselves loosely to the bark of trees, extracting nourishment from the rain and from the aqueous vapour of the atmosphere. Yet notwithstanding the abundance and variety of orchids in the equatorial forests, they seldom produce much effect by their flowers. This is due partly to the very large proportion of the species having quite inconspicuous flowers; and partly to the fact that the flowering season for each kind lasts but a few weeks, while different species flower almost every month in the year. It is also due to the manner of growth of orchids, generally in single plants or clumps, which are seldom large or conspicuous as compared with the great mass of vegetation around them. It is only at long intervals that the traveller meets with anything which recalls the splendour of our orchid-houses and flower-shows. The slender-stalked golden *Oncidium* of the flooded forests of the Upper Amazon, the grand *Cattleyas* of the drier forests, the *Caloglyphes* of the swamps, and the remarkable *Vanda Lorei* of the hill forests of Borneo, are the chief examples of orchid beauty that have impressed themselves on the memory of the present writer during twelve years' wandering in tropical forests. The last-named plant is unique among orchids, its comparatively small cluster of leaves sending out numerous flower stems, which hang down like cords to a length of 8 feet, and are covered with numbers of large star-like crimson spotted flowers." (Wallace's "Tropical Nature.")

The perianth consists of six parts in two series, an outer of three pieces (sepals), and an inner of three pieces (petals), alternate with the sepals. As in so many monocotyledonous flowers, the two series are generally similar and petaloid; they are adherent at their base to the ovary. The posterior petal, which sometimes becomes anterior by the twisting of the ovary, forms the lip (labellum), which is so often altered in shape and conspicuous in size and colour. The filaments of the stamens are united with the style to form a single column, which bears on the side remote from the lip a single anther, and two lateral processes which represent the abortive anthers. In the Lady's Slipper Orchid (*Cypripedium*) there are two perfect lateral anthers, with an abortive anther opposite the odd sepal. The pollen is

powdery, or in grains, cohering more or less together, or in waxy masses, which sometimes are provided with a stalk (caudicle), attached to glands at the apex (rostellum) of the stigma. The ovary is inferior and one-celled. The capsule breaks up into three valves, with placentas in the middle, bearing numerous minute seeds with a loose skin. A great deal of interesting matter on the relation of the structure of the flowers to the visits of insects will be found in Darwin's "Fertilization of Orchids." See Plate.

OR'CHIL or **ORCHEL'LA**. See **ARCHIL** and **CRO-BEAR**.

OR'CHIS is a genus of plants, after which the order **ORCHIDEE** is named. The species are herbaceous perennials. Each year a new tuber is produced by the side of the old one, from which the new plant next year springs, the whole of the old plant dying down. In this way the plant changes its position slightly every year. The upper sepal generally arches over the flower, and the lip is three-lobed and spurred. The two-celled anther is adnate to the column. There is a pollen-mass in each cell, waxy, and consisting of numerous lobes. Each mass is stalked, and the glands of the stalks terminate in a single pouch. There are several species in Europe and the temperate parts of Asia, but not many in America. There are eleven British species:—(1) The Green-winged Orchis (*Orchis Morio*), found in England and Ireland only, which has the perianth forming a kind of helmet, marked with green veins; (2) the Early Purple Orchis (*Orchis mascula*), with the sepals acute, the two outer being reflexed upwards; (3) the Spotted-hand Orchis (*Orchis maculata*), with the sepals spreading, while the petals converge, and with a solid stem; (4) the Marsh Orchis (*Orchis latifolia*), which has an obscurely lobed lip, with its sides at length reflexed, the upper sepal and petals converging, and the stem hollow; (5) *Orchis incarnata* is but little known, though it occurs in abundance on the sands at Southport and in Hampshire. Mr. C. B. Clarke called attention to it in a paper read at the Linnean Society in 1881, and distinguishes it from *Orchis latifolia* thus:—It has pale green leaves, never spotted; the spike is cylindric, dense with strict flowers; few of the bracts are longer than the flowers; the flowers are a pale flesh colour, with yellowish lip, and never any purple about them. (6) Pyramidal Orchis (*Orchis pyramidalis*) with rose-purple flowers, which at first are arranged in a pyramidal spike; (7) the Lizard Orchis (*Orchis hircina*), found in Kent, Surrey, and Suffolk, with the middle lobe of the lip very long and twisted; (8) *Orchis purpurea*, found in Kent, which has the basal lobes of the lip linear-oblong, and the helmet dark purple; (9) *Orchis militaris*, occurring in Herts, Bucks, Berks, and Oxfordshire, with basal lobes linear, and the helmet pale purple or ash-coloured; (10) *Orchis Simia*, found in Kent, Berks, and Oxfordshire, which has all the lobes of the lip long, narrow, and one-veined, and a dark-purplish helmet; (11) *Orchis ustulata*, found in England, with small flowers, dark purple helmet, and white lip with purple spots.

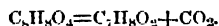
The Greenman Orchis is *Acerus anthropophora*, found in England; it has greenish-yellow flowers, without a spur. The Frog Orchis is *Habenaria viridis*. It has the glands of the pollen-mass naked, and has a very short spur. *Habenaria bifolia* and *Habenaria chlorantha* are both known as the Butterfly Orchis; both have slender spurs; the former has the nether-cells parallel, while the latter has them distant at the bases. In the genus *Ophrys* the perianth is not helmet-shaped, there is no spur, and the glands have each a pouch. It contains the Bee Orchis (*Ophrys apifera*) and the Fly Orchis (*Ophrys muscifera*), found in England and Ireland, and the Spider Orchis (*Ophrys araneifera*) and the Late Spider Orchis (*Ophrys arachnites*), found in the south of England. The Musk Orchis (*Herminium Monorchis*), found in the south of

England, has a bell-shaped perianth and the lip three-lobed without a spur.

The tubers of orchises contain starch, which is extracted in Turkey under the name of *sulep*, and is considered nutritious.

ORCHOMENOS (the modern *Skripu*) was a wealthy town of ancient Greece, situate near the Lake Kopais in Bœotia, and originally the capital of the Minuæi, who possessed all that region till the time of the Trojan War. It was captured by Hēraklēs, and later on it fell under the power of the Bœotians. It was destroyed 367 B.C. by Thebes, and all its inhabitants murdered or sold into slavery. Philip of Macedon restored it in 338 B.C. as a counterpoise to Thebes, but it never regained its power. It contains the famous "treasury of Minuas," a circular building within a hill, with an entrance passage, probably a tomb, coeval with the "treasury of Atreus" at Mycenæ. The masonry of the treasury has disappeared. Orchomenos was in extreme antiquity a centre for a festival of music and song. There was another town of the same name in Arcadia, near Mantinea.

OR'CIN, a substance found in all the lichens, used in making the blue dyes arcelil and litmus, more especially in species of *Rocella* and *Lecanora*. These lichens contain orsellic or orsellinic acid ($C_9H_6O_4$)—an acid forming colourless prismatic crystals, soluble in water; and the solution when boiled for some time gives off carbonic acid, and leaves ocuin, $C_7H_6O_2$, by the following reaction



Orcin crystallizes in colourless prisms, soluble in water, alcohol, and ether. It melts at $100^\circ C.$ (212° Fahr.), and at a higher temperature sublimes unchanged. It gradually turns red in contact with air. The same effect is produced by nitric acid, and the red dye thus obtained is soluble in water, alcohol, and ether, and dyes wool and silk red without a mordant. With chlorine, bromine, and iodine it forms trichlororcic ($C_7H_3Cl_3O_2$), tribromorcic ($C_7H_3Br_3O_2$), and tri-iodorcic ($C_7H_3I_3O_2$), all colourless crystalline bodies.

Resorcic ($C_6H_4O_2$) is obtained by fusing gum galbanum with caustic potash; it crystallizes in tabular, colourless crystals, very soluble in water, alcohol, and ether. It melts at $99^\circ C.$ (210° Fahr.), boils at $271^\circ C.$ (520° Fahr.), and distils unchanged. It is much used in colour-making; it gives a deep blue with ammonia, and is reddened by acids. Chloride of lime and ferric chloride give deep violet coloured solutions with resorcic. It is a powerful antiseptic, and is used in medicine in a weak solution as an application to unhealthy wounds, and also in small doses internally as a febrifuge.

ORDAINERS, LORDS. These were a body of twenty-one barons appointed in 1310 (like the twenty-four barons of Magna Carta nearly a century before) to watch the king as to his performance of the charters he had sworn to. Edward II. had broken so many oaths that no other course was left than thus to put the crown into commission, if civil war was to be avoided. The lords ordainers, who were appointed by consent of the king, forced from him by practically the whole of the baronage, in the name of Parliament, consisted of two earls elected by all the bishops, two bishops by all the earls, two barons by the four lords thus chosen, and fifteen others by the first chosen six. Six ordinances were issued by the king under the compulsion of this body in August, 1310, and thirty-five during 1311. They checked the royal assumptions, abolished PURVEYANCE, &c., and were aimed particularly at the overweening arrogance of the king's favourite, Piers Gaveston. They abolished the New Customs (*Nova Custuma*), reaffirmed in 1328, confirmed charters, restored the crown lands lavishly granted to favourites, restricted the king from making war, leaving the kingdom, or tampering with the coinage, without the consent of Parliament, claimed

the right in the name of Parliament to nominate ministers, and provided for frequent Parliaments. The king tried to shake off the ordinances, but the lords ordainers solemnly renewed them in 1316. In 1322 Edward had regained sufficient power to listen to the flattery of the Despencers, and formally annulled them as "prejudicial to the estate of the crown," assuming arbitrary government. The new tyranny lasted only five years, and Edward was deposed in 1327, under parliamentary sanction.

ORDEAL (a dealing-out, *i.e.* a judgment; Old English *del*, with the prefix *or* or *ur*, out; Ger. *urtheil*, judgment), a name given to a mode of trial which has prevailed from the remotest antiquity, and which is still largely used by savage and semi-civilized peoples everywhere. Some forms of ordeal are simply magical, and represent processes of divination turned to legal purpose; but the great majority are based upon the assumption of the intervention of a deity for the protection of the innocent or for the detection of the guilty. The use of the ordeal appears to have prevailed in India from the period of its invasion by the Aryan races, and a close historical connection has been traced between the Hindu ordeal laws with those of primitive Europe. In the writings of the Greek and Roman historians there are numerous references to the use of ordeals by fire and water, but they seem to have been believed in chiefly by the lower classes. A description of an ordeal for the detection of adultery is given in Num. v., the details of which greatly resemble a practice common in Brahmanic India at the present day. Among the Jews the suspected woman was required to drink some "water of bitterness," in which some of the dust of the tabernacle had been mingled, and which had been used to wash out the words of the curse invoked upon her in the event of her being guilty. By some commentators the draught is supposed to have been harmless in itself, while others regard the use of the term bitter as implying the admixture of some drug or poison. It was supposed to cause the body to swell and the thigh to fall away in the case of the guilty, but its influence was only beneficial to those who were innocent. In Brahmanic law one form of ordeal requires the accused to drink three handfuls of water in which a sacred image has been dipped, while another requires the administration of a decoction of aconite root, sickness being regarded as an evidence of guilt.

In the early centuries of the Christian era we find ordeals of fire and water existing as part of the law and being conducted with much formality by the clergy. Sometimes points of doctrine were submitted to this test, and there is a curious illustration of the survival of this practice in connection with the life of Savonarola. The ordeal by fire seems to have been reserved for persons of high rank, bondsmen and rustics being tried by water ordeals. By the ancient English laws the accused who was tried by fire was required to carry in his hand a bar of red hot iron a distance of nine steps, or was required to walk barefoot over nine glowing ploughshares. Sometimes the accused was blindfolded and required to walk down the centre of the church, the heated ploughshares being laid upon the ground at irregular intervals. If he stepped over them unharmed it was regarded as a sign of innocence, but if he stepped upon them and was burned he was considered guilty. An oft-repeated but non-historical story represents Queen Emma, the wife of Edward the Confessor, as clearing herself of an accusation of adultery by means of the ordeal of the ploughshares. Sometimes the iron was made in the form of a gauntlet, into which, when heated red hot, the accused was required to thrust his hand, and in another form of the fiery ordeal he was compelled to thrust his hand into a brazier full of burning coals. Had some of these tests been carried out in their integrity the ordeal could have had only one result, but it is evident that the clergy possessed sufficient power over the necessary ar-

rangements to enable them to secure the acquittal of those who were able to purchase their favour. In the *ordal by water* the hands and feet of the accused were bound together, the right hand being fastened to the left foot and the left hand to the right foot, a rope was then fastened round his waist, and he was flung into the water, which was supposed to receive him—*i.e.* permit him to sink—if he was innocent, but which would reject him or cause him to remain on the surface if he was guilty. In this test it is evident that much would depend on the tension of the rope by which the accused person was lowered. During the mediæval period the ordeal by swimming was the favourite method for trying suspected witches, and relics of this superstition may still be found in some parts of Europe. In the ordeal by boiling water, according to the laws of Athelstan, a stone was dropped to the bottom of a vessel filled with the water, and the hand had to be inserted as deep as the wrist in order to bring it out. A more severe form of this ordeal required the arm to be plunged into the water up to the elbow. Sometimes boiling oil was used instead of water, and occasionally melted lead was substituted. In the latter case it would not be difficult to obtain a favourable verdict, as it is well known that under certain conditions the hand may be plunged into melted metal with impunity. Methods for rendering the skin insensible to a considerable degree of heat are still practised by conjurors, and it is not at all unlikely that these or similar devices were known to the ancient priesthoods of heathenism and of Christianity. In the ordeal by the bier a person suspected of murder was required to touch the body of the murdered person, it being supposed that the blood would flow afresh at such a touch. Shakspeare in his "Richard III.," act 1, scene 2, makes the body of King Henry VI. bleed on the approach of his murderer Gloucester, and Sir Walter Scott introduces a similar incident in his "Fair Maid of Perth." The old ordeal by battle, used in English law, has already been noticed under **APPEAL**. An ordeal by consecrated bread and cheese, which can be traced back as far as the second century, was in high favour in Europe during the early part of the mediæval period. The consecrated pieces of food were given to the accused person from the altar, and he was required to eat them in the presence of the congregation. If he was guilty it was supposed that he would be unable to swallow the food, or that in the attempt to do so he would be choked. Godwin, earl of Kent, in the reign of Edward the Confessor, accused of the murder of the brother of the king, is said to have appealed to the ordeal of the *corssuel* or consecrated slice, and to have been choked by the mouthful. It is a well-known fact that under the influence of fear the month becomes dry and parched, and it is not at all unreasonable that guilty men, believing devoutly in the efficacy of the ordeal, have been detected by this simple means. At the present day it is a favourite device of the police in India, when examining a suspected person, to make him chew and spit out a mouthful of rice, and to form conclusions from the presence or absence of moisture in it. In England trial by ordeal was continued till the middle of the thirteenth century, but the more primitive forms had given way to the ordeal by battle for some time previous to this. In the practice of duelling, which still lingers on in France and Germany, we may see a survival of the old wager of battle.

At the present day the ordeal seems to be prevalent throughout the greater part of Africa, where it causes an immense destruction of life. By many of the native races most of the evils which fall to their lot are ascribed to witchcraft, and the witch doctors or sorcerers are allowed to use a great variety of absurd ordeals in order to detect the guilty persons. A very common test is the drinking of a poisonous draught, vomiting being taken as the sign of innocence. As the whole preparation of this draught

is left to the witch doctor, he has the power of dealing out death at his pleasure, a power which he does not fail to turn to his own advantage. It not unfrequently happens also that suspected persons, conscious of their innocence, eagerly embrace the test by ordeal, only to find out too late that they have betrayed themselves to death.

ORDER OF THE DAY, a parliamentary usage, by which a question already proposed to the House is got rid of, without embarrassing the House with the necessity of accepting or rejecting it. To effect this object, motion is made for "the order of the day"—i.e., the regular business of the day—"to be read." When this is carried, the various "orders," or business, set down for the day are taken up in regular rotation, and the question on which the House was unwilling to pronounce an immediate opinion is necessarily shelved. This first took place in the English Parliament on the 1st of April, 1747.

ORDERICUS VITALIS, son of a married priest of Ateham, on the Severn, a native of Orleans, who had come over with William the Conqueror, is one of the chief authorities for the reign of Henry I. In 1085, when he was ten years old, his father retired to a Benedictine monastery near Shrewsbury, giving half his property to the monastery and half to a younger son, taking Orderic with him. Hence Orderic went to the Abbey of St. Evroult in Normandy, was received into the Benedictine order while yet a boy, and took the church-name of Vitalis. He lived ever after among the books there, studying and writing. His great work was the famous "Ecclesiastical History of England and Normandy," beginning, like most of such works, with a condensed account of history from the times of Christ, but expanding into fullness and real value as it nears his own time, abounding in genuine letters, proclamations, and accounts of councils and great meetings, not wanting, moreover, in racy perception of characteristic traits. The chronicle breaks off abruptly in 1142, and as Orderic would then be sixty-seven, it is to be supposed that his death happened shortly after that year.

ORDERLIES are the soldiers of a regiment whose duty it is to wait upon the commanding officers, and to communicate their orders and messages to the men. The orderlies are usually the sergeants in each company who are on duty for the week. An *orderly officer* is the one whose turn it is to superintend the cleanliness of the regiment, and to see that the food supplied to the men is of the proper description and quality.

ORDERS, HOLY, a term applied in its most general sense to the ministry of the Christian Church. In the earliest days of the church we meet with one office only, that of apostle, as distinct from the general body of believers. As the latter multiplied, a system of organization became necessary, and following in the familiar lines of the Jewish synagogue, Christian elders were appointed to take charge of the congregations as they were formed. At Jerusalem the name elder was taken as being that in general use, but when churches were founded in Gentile countries the title of *episkopos*, equivalent to superintendent, was more generally adopted. These elders or bishops were required to be men of mature years, good character, able to teach and to administer affairs (1 Tim. iii. 1-7). In addition to these certain subordinate officers were appointed, as in the Jewish synagogue, who in the church were termed deacons (1 Tim. iii. 8-13). In more than one of the epistles the bishops and deacons are named as apparently an exhaustive division of the officers of the churches. Soon after the apostolic period the clergy began to be distinguished into three orders—bishops, presbyters, and deacons, and in the third century some additional minor orders were instituted. The members of the minor orders were required to attend upon the ministers in divin service, and attention to the duties of this kind was insisted on as a preliminary training for higher office. These minor orders appear to have consisted

of the subdeacons, acolytes, exorcists, readers, and door-keepers. The original duty of the subdeacons was to prepare the sacred vessels used in the eucharist, and to deliver them at the appointed times to the deacons. By the Western Church the office of subdeacon became one of the major orders, but the Eastern churches generally exclude it. The acolytes acted as attendants, lighting the candles in the church, and bringing the wine and water to the celebrant of the Eucharist. The exorcists were empowered to cast out devils from those regarded as being under demoniacal possession; the readers had the duty of reading the Scriptures from the reading desk to the congregation; and to the door-keepers was intrusted the duty of excluding from the service excommunicated persons, and of separating the faithful from the catechumens. In the Roman Catholic Church the minor offices of door-keeper, reader, exorcist, and acolyte are retained, but in the Greek Church all these minor orders are united into one, that of reader.

In the Anglican and other Reformed Episcopal churches the three higher orders of bishop, priest, and deacon are retained, but the minor orders are not used. In the Presbyterian and other non-Episcopal churches, the one order of presbyters is alone retained. In the Greek and Roman churches orders are regarded as a sacrament, and though by the twenty-fifth article of the Anglican Church this doctrine is rejected, the latter church has always attached a peculiar sanctity and authority to those invested with the sacred office. For a notice of the controversy as to the nature of orders which has prevailed between the Episcopal and non-Episcopal churches see under **BISHOP**.

ORDERS IN COUNCIL. Under certain defined limits the sovereign of the United Kingdom is authorized by Parliament to issue and enforce executive orders with the advice of the Privy Council. These are termed "orders in council," and they are issued largely in connection with commerce and revenue and under international questions. Though it is fully established that the Privy Council has no power to legislate except so far as authorized to do so by Parliament, it is difficult to draw the line between what may and may not be accomplished by an order in council. There have been also various occasions on which, in cases of emergency, orders in council have been issued contrary to law, and those who have been concerned in passing, promulgating, or enforcing them have trusted to legislative protection and taken on themselves the personal responsibility of the proceeding. In the year 1766, when there was a deficient harvest and the prospect of famine, an order in council was issued prohibiting the exportation of corn from the British ports. In the immediately ensuing Parliament, the Act 7 Geo. III. c. 7 was passed for indemnifying all persons who had advised the order or acted under it, and for giving compensation to all who had suffered by its enforcement. The Act in reference to the order declared, "which order could not be justified by law, but was so much for the service of the public, and so necessary for the safety and preservation of his Majesty's subjects, that it ought to be justified by Act of Parliament." Still more famous are the orders in council issued by the British government in 1807-9, in its efforts to neutralize the effects of the Berlin and Milan decrees of Napoleon, by which Great Britain and her colonies were declared in a state of blockade.

The Berlin decree, issued 21st November, 1806, declared the whole of the British Islands to be in a state of blockade, and all vessels trading to them liable to capture by French ships, all British vessels and produce being shut out from France and all the other countries obedient to the French. All neutral vessels were required to carry certificates of origin, issued by the French consuls of the ports from which they had sailed, that no part of their cargo was British. In retaliation the British government issued in 1807 successive orders in council subjecting to seizure all neutral vessels trad-

ing from one hostile port of Europe to another with property belonging to an enemy; and declaring France and all states subject to the French to be in a state of blockade, and all vessels which were found to have French certificates of origin on board liable to seizure. All neutral vessels intended for France or any other hostile country, or clearing from these countries, were required to touch first at some British port and pay custom-house dues there if they wished to be exempt from seizure. This was followed by the Milan decree of Napoleon, issued 27th December, 1807, extending the blockade to the whole British dominions, and prohibiting all countries from trading with each other in any articles of British produce or manufacture. Subsequent orders in council limited the blockade on the part of the British to France, Holland, a part of Germany, and the north of Italy, and provided for the issue of licenses to vessels to proceed to hostile ports after they had paid customs dues at a British port. The legality of these orders has been called in question, and though they were at the time regarded as essential to the effective prosecution of the war, it appears that their influence added to the general distress which prevailed, and they certainly greatly exasperated neutral countries.

At the present day, though a law cannot be enacted by an order in council, power may be delegated by Parliament to the sovereign in council to suspend a law or put a law in force, according to circumstances. Thus in the Customs Duty Act, when there is any scale of duties to be paid by the subjects of a state having a treaty of reciprocity with Great Britain, it is enacted that the treaty of reciprocity, and consequently the right to import at the lower duties, shall be declared by order in council. By the International Copyright Act, 1 & 2 Vict. c. 59, the countries which, by their conceding a term of copyright to works published in Great Britain are to enjoy a similar privilege here, may be declared by order in council. At certain periods of extreme monetary difficulty the currency law as it affects the Bank of England has been set aside by an order in council; but an Act of Indemnity has always been passed afterwards.

ORDERS OF ARCHITECTURE. See GREEK ARCHITECTURE.

ORDERS OF MERIT. The practice of bestowing badges to be worn as marks of merit or authority has prevailed among nearly all nations from the remotest antiquity. The desire to be distinguished above others is one of the strongest feelings in the human breast, and in consequence we find that everywhere men recognize this feeling and agree to confer certain outward symbols of merit upon those who obtain their approbation. Among semi-civilized peoples, with whom warfare is the normal condition of existence, valour is the virtue prized above all the rest, and the badge most coveted is that which speaks of the prowess of the wearer in contending against tribal enemies. Where the people are ferocious and cruel as well as pugnacious, this symbol may take a very objectionable form in the shape of some portion of the body of the slain enemy. Thus, among some of the tribes of the Eastern Archipelago, the order of merit that is most highly prized is that which is marked by a house adorned with the dried heads of enemies slain in battle, the proud possessor of a number of these ghastly trophies being regarded with admiration by those who are less favoured or who are destitute of such treasures. The scalp worn at the girdle by the North American Indian was among the Indians a highly prized order of merit, while a necklace made from the claws of a grizzly bear spoke of a more innocent victory over a dreaded tyrant of the forest. Even among the nations which regard themselves as civilized at the present day, courage and prowess in warfare are qualities deemed most worthy of respect, and the emblems of distinction most esteemed are those which have reference to service

rendered to the state in waging defensive or aggressive warfare. At the same time, with the progress of society, other kinds of service are recognized, and superior ability in the direction of legislation or diplomacy, in poetry, literature, or art, call for notice, and from time to time special orders of merit are created in their honour. Once instituted and established, an order of merit offers a convenient method of rewarding service, or stimulating honourable ambition, and very often in the course of time the terms of admission are greatly modified, and the distinction is prized for very different reasons from those which gave rise to its first institution. Thus in Europe the highest orders of merit were exclusively military in their origin, but like the titles borne by the nobility, as mentioned elsewhere [see NOBILITY], this characteristic has been modified in the course of time, and now, in many instances, admission is granted without any reference to military service.

Among the first of the existing orders of merit, both in point of antiquity and dignity, stands the British Order of the Garter, of which a portion of the insignia is shown in Plate I. Considerable mystery hangs over the foundation and early history of this order, and though the statement of Selden, which fixes the eighteenth year of Edward III. (1341) as the year of its foundation, is corroborated by Froissart, it must be admitted that there is a complete absence of all authentic records on the subject. The annals of the order have been kept with some amount of precision since the reign of Henry VIII., but for the period previous to this they are exceedingly imperfect. Some of the traditions concerning the order have been already mentioned under GARTER, ORDER OF THE. The Garter shown in the Plate is of dark blue ribbon edged with gold, bearing the motto "Honi soit qui mal y pense," in golden letters, with buckle and pendant of gold richly chased, and is worn on the left leg below the knee. The collar of the order is of gold, and consists of twenty-six pieces, each in the form of a garter, enamelled, azure, and connected together. Below the collar and attached to it is worn the "George," a figure of St. George on horseback encountering the dragon. The "lesser George," a similar figure surrounded by the garter, as shown in Plate I., is worn pendent to a broad dark-blue ribbon over the left shoulder. The star of eight points, silver, has upon the centre the Cross of St. George, gules, encircled with the Garter.

According to some authorities the Order of the Bath was originally instituted in the same century as the Order of the Garter, on the occasion of the coronation of Henry IV. in 1399, the initiated knights being required to bathe and fast before being admitted to the order. The last Knights of the Bath made according to the ancient forms were those at the coronation of Charles II.; and from that period until the reign of George I. the old institution fell into oblivion. When the Order of the Bath was revived by George I. in 1725, the number of knights, independent of the sovereign, a prince of the blood royal, and a great master, was restricted to thirty-five. On the conclusion of the war in 1814, it was deemed expedient to extend considerably these limits, and on the 2nd January, 1815, it was declared that "for the purpose of commemorating the auspicious termination of the long and arduous contest in which this empire has been engaged, the order should be composed of three classes; and on 14th April, 1847, it was further extended by the addition of civil knights, commanders, and companions. The number of the members of the first class, or knights grand-cross, was fixed by the latest statutes at fifty for the military service and twenty-five for the civil service, exclusive of the sovereign, princes of the blood royal, and such distinguished foreigners as might be nominated honorary knights grand-cross. Of the knights commanders of the second class the number

was not to exceed 102 for the military service, and fifty for the civil service, unless it should become desirable to reward actions of signal distinction; while the number of the members of the third class, or the companions of the order, was to consist for military service of 525, and for the civil service of 200. The badge for the military classes of the order is a gold Maltese cross, of eight points enamelled, argent; in the four angles, a lion passant-guardant or; in the centre, the rose, thistle, and shamrock, issuant from a sceptre between three imperial crowns or, within a circle, gules; thereon the motto of the order, surrounded by two branches of laurel proper, issuing from an escrol, azure, inscribed *ICI DIEN* (I serve), in letters of gold. It is worn by the grand-crosses pendent from a red ribbon across the right shoulder, by the knights commanders from the neck, and by the companions from the button hole. The star of the military grand-crosses is formed of rays or flames of silver, thereon a gold Maltese cross, and in the centre, within the motto, branches of laurel, issuant as in the badge. The star of the third class is in the form of a cross-patée of silver, having the same centre as the grand-crosses, but without a gold Maltese cross thereon.

The Scottish Order of the Thistle has been by some historians carried back as far as Saxon times, but in reality it dates from the reign of James II. of England and VII. of Scotland, and after his abdication the order fell into desuetude until it was revived in 1703 by Queen Anne. The jewel of this order consists of a figure of St. Andrew, of gold enamelled, with his gown green and the surcoat purple, bearing before him the cross, enamelled white, the whole surrounded by rays of gold in the form of a glory, the cross and feet resting upon the ground, the whole surrounded by the motto of the order, "*Nemo me Impune Lacessit*." The star consists of a St. Andrew's cross, of silver embroidery, with rays emanating from between the points of the cross, in the centre of which is a thistle of green, heightened with gold, upon a field of gold, surrounded by a circle of green, bearing the motto of the order in golden characters. By a statute passed in May, 1827, the order is to consist of the sovereign and sixteen knights.

The Order of St. Patrick was instituted by George III. in 1783, and it has since numbered among its members a brilliant succession of distinguished men, selected from the most eminent, for birth, rank, or personal achievement, among the Irish Peers. The jewel of the order is of gold, of an oval form ornamented with shamrocks, within which is a circle of sky-blue enamel containing the motto and date "*Quis separabit, MDCCCLXXXIII.*" ("who shall separate us," 1783), encircling on a field argent the cross of St. Patrick gules, charged with a trefoil vert, having on each of its leaves an imperial crown or. The star consists of the cross of St. Patrick gules, on a field argent, surmounted by a trefoil vert, charged with three imperial crowns within a circle of azure containing the motto and date in letters of gold, the whole surrounded by rays of silver.

The Victoria Cross, which was instituted at the close of the Crimean War in 1856, may be granted to a soldier or sailor of any rank as a reward for distinguished courage, and it is granted on no other condition. The cross is made of bronze obtained from the guns taken from the Russians, and it has in the centre a royal crown, surmounted by a lion, and below on a scroll the words "*For Valour*." The ribbon is red for the army and blue for the navy, and the clasp, which bears two branches of laurel, is attached to the cross by the letter V. This decoration entitles the recipient to a pension of £10 a year. The number of Victoria crosses is not limited, but as the decoration is very sparingly bestowed and always implies distinguished gallantry in the presence of the enemy, the possession of this "glorious bit of gun-metal" is greatly coveted by military and naval men.

Of the French orders those belonging to the *LEGION D'HONOUR* will be found fully described under that heading, while in the wreaths of gold and silver awarded by the department of public instruction and the *Académie Française*, we see the recognition of merit in learning and art.

The highest order of merit of Prussia, namely, that of the Black Eagle, was founded on the 17th January, 1701, by the Elector of Brandenburg, on the occasion of his coronation as King of Prussia. The insignia of the order, as shown on Plate I., consist of an octagonal cross of blue enamel, a black eagle being displayed between each of the arms of the cross, and of a silver star, in the centre of which a black eagle flying and bearing a thunderbolt and a laurel wreath is shown, surrounded by the legend "*Suum cuique*." The Order of the Red Eagle, which stands second in rank, has passed through many modifications since its foundation in 1734. Its members are divided into two classes, the members of the first class only being permitted to wear the star. The jewel of the order, a Maltese cross of white enamel, is common to all the members. The Order of the Iron Cross was instituted on 10th March, 1813, by Frederick William of Prussia, and was conferred for distinguished services in the war then being carried on. The possessors of the decorations are, with the exception of the Knights of the Grand Cross, divided into two classes, though the cross is of the same form and character in both, being composed of cast iron with silver mounting, and bearing no inscription on the reverse. The obverse bears the initials F. W. with a crown, the date 1813, and a wreath of oak-leaves. The decoration of the grand-cross, which is granted exclusively for the gaining of a decisive battle, the conquest or brave defence of a fortified position or place, is similar in shape and construction, but is double the size of the ordinary cross. The Order of the Iron Cross was brought into special prominence during the Franco-Prussian war of 1870-71.

Of the Russian orders that of St. Andrew is the highest in the empire. It was founded in 1698 by Peter the Great, and it is confined to members of the imperial family, princes, generals-in-chief, and other persons of high rank, and with the order the nominee receives also the St. Alexander Newski, St. Ann, and St. Stanislaus decorations. The jewel consists of the figure of St. Andrew on a blue enamelled cross, resting upon the eagle of the empire with three crowns. It is worn across the right shoulder towards the left hip, by a sky-blue ribbon. The star shows in the centre the double eagle of the empire, encompassed by a bright blue ring, containing the legend (in Russian) "*For Faith and Loyalty*." The Order of St. Alexander Newski, which was also founded by Peter the Great, was instituted on the occasion of the establishment of his new capital on the Neva, but he did not bestow the decoration upon any one, the first knights being admitted by his consort Catharine after his death. The insignia consist of an octagonal red enamelled cross, showing in its corners the imperial eagle in gold, and in a white enamelled middle the figure of St. Alexander on horseback. It is worn across the right shoulder towards the left hip by a flame-coloured ribbon. The silver star is worn on the left breast, and contains the initials S.A. (St. Alexander) beneath an imperial crown. On a red ring round the initials is seen the motto of the order (in Russian) "*For Merit of the Fatherland*." The Order of the White Eagle was originally instituted by Augustus II. in 1703, who, when obliged to flee from the Polish provinces, conferred this decoration upon a number of distinguished personages who had been faithful to him. After a very chequered history it was united with the orders of Russia in 1831, and given a place next after that of the Alexander Newski. The decoration, not unlike that of the Maltese cross, contains upon its face the white eagle, the whole being surrounded by rays, and resting upon the eagle of the empire.

The star of gold contains an enamelled cross in the centre within a blue ring, bearing the motto of the order, "Pro Fide, Rege, et Lego" (For religion, king, and law).

Of the Austrian orders that of the Golden Fleece dates from the year 1429, when it was founded by Philip III. of Burgundy. The curious history of this order has already been noticed under GOLDEN FLEECE, ORDER OF THE. Its insignia consist of a golden fleece hanging on a blue enamelled flint stone emitting flames of fire, and borne, in its turn, by a ray of fire. On the enamelled obverse are inscribed the words (from Claudian), "Pretium laborum non vile" (Not a bad reward for labour). The two orders shown next on the Plate owe their origin to Maria Theresa. The first, which is called after her name, was founded in 1757 in acknowledgment of the valour, wisdom, and loyalty displayed by her officers in the memorable contests of her reign. The claims to the order rest chiefly upon personal military merit, irrespective of birth, duty, favour, family connection, or long service. The number of members is unlimited, but the decoration is very sparingly bestowed. The badge of the order is an octagonal cross, enamelled white, and set in gold. The centre contains the Austrian arms, surrounded by a white margin, in which is inscribed the word "Fortitudini" (For Valour) in golden letters. The reverse shows, on white ground, the initials in monogram, M. T. F. (Maria Theresa and Francis), encompassed by a golden ring and laurel wreath. The star of silver represents on its face the order, resting on a laurel wreath. The next order shown, viz. that of the Apostolic Order of St. Stephen, was founded by Maria Theresa on the 5th May, 1764, on the day when the presumptive heir to the throne, the Archduke Joseph (afterwards the Emperor Joseph II.), was crowned King of Rome. By the statutes the grand-mastership of the order is vested in the crown of Hungary, and the college consists of not more than twenty knights of the grand cross, thirty commanders, and fifty knights. The jewel consists of an octagonal cross, green enamelled, containing in the centre the apostolic silver cross within a golden crown placed on a green mountain, and the initials M. T. (Maria Theresa), with the legend "Publicum Meritorium Præmium" (Public Reward of Merit). Above the cross is appended the Hungarian gold crown. The star, which is worn only by the grand-cross knights, is embroidered in silver, and contains in its centre the obverse of the badge surrounded by a wreath of oak leaves. The Order of the Iron Crown, now belonging to Austria, was originally founded by Napoleon I. in 1805, on the occasion of his crowning himself King of Italy. Forgotten after his fall, it was adopted and remodelled in 1816 by the Emperor Francis I., who made it an Austrian order of high dignity, a position which it still retains. The decoration consists of a gold crown of the same shape as the celebrated Iron Crown, surmounted by the two-headed eagle of Austria, bearing upon the obverse a blue escutcheon with the letter F (Francis), and on the reverse the date 1816.

The Order of "Fidélité" of Baden represents the highest order in the grand-duchy, and it was founded by Margrave Charles William of Baden, Durlach, and Hochberg, on 17th June, 1715. It was renewed on the 8th May, 1803, by the Elector, afterwards Grand-duke Charles Frederick, margrave of Baden, on the occasion of the electoral dignity being transferred to the reigning house of Baden. The jewel consists of an octagonal cross with the ducal crown above it, enamelled red, and two C's in monogram connecting each of the four corners. The same initial is seen on the white centre, where it is surrounded by the motto of the order, "Fidelitas" (Loyalty). To the silver octagonal star is appended a similar cross, except that the motto and the middle scutcheon are of orange colour.

The knightly Order of St. Hubert of Bavaria is of much

earlier date, having been originally founded by Gerhard V. in memory of a great victory obtained on St. Hubert's Day, 3rd November, 1441. It became extinct in 1609, and after being forgotten for nearly a century, was revived in 1708. It is at present regulated by the statutes promulgated by Maximilian Joseph IV. (first king of Bavaria) on the 18th of May, 1808. The jewel of the order, which is worn attached to a poppy-red ribbon, consists of a golden cross, white enamelled, while between each of the arms of the cross are seen three golden points, and above the whole the royal crown. The central field represents on the obverse the history of the conversion of St. Hubert, surrounded by the motto of the order "In Treue fest" (Constant in Loyalty) in golden Gothic letters. The star is worn embroidered in silver on the left breast. Upon the star is attached a cross embroidered in silver, and interwoven and mounted in gold. It contains in the middle a round field of flame-coloured or poppy-red velvet, with the motto of the order.

The Turkish Order of the Medjidie was instituted after the Crimean War, when it was conferred upon a number of the officers, native and foreign, who had fought against Russia. It is divided into five classes, and the decoration, which differs in size for the different classes, consists of a silver sun with the device of the crescent and star alternating with the rays. On the centre the name of the Sultan is engraved on a gold ground, and round this, on a circle of red enamel, is the legend in Turkish characters signifying "Zeal, Honour, and Loyalty."

The first Spanish order, shown on Plate II., that of the Knights of Calatrava, was founded in 1158 by the brave Cistercian abbot Raymond at the town of Calatrava la Vieja, a place which formerly stood on the south bank of the Guadiana, about 21 miles from Toledo. The statutes of the order received papal sanction soon after 1164. The object for which the order was instituted was that of doing battle with the Moslem invaders of Spain, a task which the members discharged with such courage and devotion as to earn for themselves the title of "the gallant order." Originally a monkish order, it was partially secularized by Pope Innocent VIII., who transferred its administration to the king, giving the members at the same time permission to marry. The Spanish Order of St. James, or, as it is generally termed, St. James of Compostella, dates from a period almost equally remote, having been founded at Compostella, the capital of the province of Galicia, a few years prior to 1175, the date on which the statutes of the order received papal assent. The knights of this order acknowledged as the object of its foundation the duty of protecting Christians, and converting unbelievers by means of the sword, and they received permission from the Pope to retain for their own use as a collective body all lands taken from the Moslems. In course of time the order became so enormously wealthy and powerful as to excite the jealousy of the crown, and ultimately in 1522 the grand-mastership was vested for ever in the king by the Pope. This led to a speedy decline in its wealth and importance, but it still remains the first of the four military orders of Spain.

The Italian Order of the Annunziata was instituted in 1360 by Amadeus VI., duke of Savoy, and was known originally as the Order of the Neck-chain or Collar. The king is always grand master of this order, and though the number of knights is unlimited, it is confined to persons of high rank, and only those who have already been admitted to the orders of St. Mauritius and St. Lazarus can become members. The jewel is a gold medal, on which is represented the annunciation, surrounded by love knots. The star did not originally form part of the ornaments of the order, but it was added to them in 1680. It is embroidered in gold, and worn on the left breast, and it bears in the centre a representation of the annunciation. The letters

shown round the star, F. E. R. T., are of uncertain origin, the interpretation most generally accepted, however, being that they represent an old motto of the counts of Savoy, "Fortitudo ejus Rhodum tenuit" (Rhodes was kept by his bravery), in allusion to the warlike exploits of Amadeus V. against the Turks. (See also Burke's "Book of Orders of Knighthood," London, 1858.)

ORDERS OF PLANTS. In classifying the vegetable kingdom according to the affinities of the species, it has been found necessary to collect together into groups such genera as have more resemblance to each other than they have to anything else, and to these the name of Natural Orders has been given. They constitute the foundation of all arrangements, and are wholly independent of the peculiar views which different writers have taken of the manner in which the vegetable kingdom should be otherwise classified. Thus while one author advocates the propriety of arranging exogens by the modifications of their corolla, another by the insertion of their stamens, a third by what is supposed to be the progressive order of their development, and so on, the result of each of which methods is a different sequence of matter, the natural orders themselves remain unchanged. This being so, the study of their true limitation, and of the characters by which they are essentially distinguished, constitutes by far the most important branch of systematic botany, and accordingly we find that a large proportion of the natural orders yet founded are admitted without much difference of opinion.

For the natural orders now admitted in the writings of botanists the reader is referred to the article BOTANY, and to the numerous names of orders introduced in their places in the alphabetical arrangement of this work.

ORDERS, RELIGIOUS. See articles HOSPITALIERS, TEMPLARS, TEUTONIC KNIGHTS; JOHN, KNIGHTS OF ST. OF JERUSALEM; KNIGHTHOOD, &c. Also MONASTICISM, and the several orders of monks and friars under their respective headings, as BASIL, MONKS OF ST.; BENEDICTINE ORDER; AUGUSTINIANS, DOMINICANS, FRANCISCANS, &c.

ORDINANCES, ROYAL. Legislation in England, originally by the king and his "wise men" in *witenagemot* assembled, occasionally, as in the case of the powerful Edgar, was by royal ordinance. Then followed the Norman legislation by charters, and the Angevin method of assizes or groups of statutes. But during and after Edward I. two distinct kinds ran on together, the statutes of the king in Parliament and the royal ordinances. The difference lay in the assumed temporary nature of an ordinance, in the king's power to recall it, since it was not enrolled on the statute book and was issued directly by the king, nominally as an executive, not a legislative act. [See also ORDANERS, LORDS.] This system was not found to work ill; and Edward III. is petitioned in 1364 by his Commons to revise the sumptuary laws by ordinance, so that they might amend the same at their pleasure, providing for a constant alteration as the fashions changed, which would be beneath the dignity of an Act of Parliament. Richard II. made great use of ordinances to work against his Parliaments, and the usual result followed. As Pym told Charles I., "None have gone about to break Parliaments but Parliaments have broken them," in England.

The royal prerogative still includes the power to legislate through the Privy Council by "orders in council," as the term now runs. Purchase in the army was so abolished. But the principle is a dangerous one, and by common consent is reserved for emergencies only.

ORDINARIES. See HERALDRY.

ORDINARY. This term commonly signifies the bishop of the diocese, who is in general, and of common right, the ordinary judge in ecclesiastical causes arising

within his jurisdiction. The term is also applied to the commissary or official of the bishop and to other persons having by custom or peculiar privilege judicial power annexed to their offices or dignities. Thus a bishop is always an ordinary, but every ordinary is not a bishop. In 1857 the ecclesiastical jurisdiction previously vested in bishops and their officers in relation to wills and marriages was transferred to a new judge, called the judge-ordinary, but who was entirely disconnected with the church. Since the passing of the Judicature Act of 1873 this title has become obsolete. In Scotland the lords ordinary are the Outer House judges, five in number, before whom, as a rule, cases come in the first instance.

ORDINARY, SHIPS IN. In the British navy ships are said to be in ordinary when out of actual use, moored in harbours and dockyards, and only requiring to be fitted with masts and gear for immediate service. A few sailors are in charge of each ship, and a lieutenant has the care of a number of such vessels, while a guard-ship has charge of all the ships in ordinary lying at each port. An *ordinary seaman* is one who has not served long enough to be called an *able seaman*, and who is not regarded as being capable of performing all the duties assigned to the latter.

ORDINATE. See CO-ORDINATES OF A POINT.

ORDINATION, the ceremony by which holy orders are conferred, or by which a person is initiated into the ministry of religion, or set apart for preaching, administering the sacraments, and discharging other ecclesiastical rites and duties, public or private. In the Church of England a candidate must be twenty-three years of age before he can be ordained deacon, and twenty-four before he can be ordained priest; must have an appointment to some cure, except he be a fellow of a college; bring letters testimonial of his life and doctrine, for three years from three beneficed clergymen; undergo an examination in Latin, Greek, and theological learning; subscribe to the Thirty-nine Articles and the Liturgy; and, as bishops now almost invariably require, have graduated at one of the English universities, at Trinity College, Dublin, or at some other recognized school. No person can hold any vicarage, rectory, or benefice whatever unless he be in full orders. A form of some kind has always been observed in conferring the priesthood. In the Old Testament the family, age, and qualifications of the individual appointed are particularly described. In the days of the apostles the form adopted for setting him apart was prayer and the imposition of hands. But in process of time it lost its primitive simplicity, and was elevated to the dignity of a sacrament. As such it remains in the Roman Catholic, Greek, and other Eastern churches in the present day, and there is no part of the Roman discipline which is more jealously guarded than the administration of orders. The words used are—"Take thou authority to offer up sacrifices to God and to celebrate masses, both for the living and the dead, in the name of the Father, the Son, and the Holy Ghost." In the Episcopal churches the deacons are now ordained by the bishop, the priests by the bishop and all the priests present, and the bishops by the archbishop and two or more bishops, or by three or more bishops. In such non-Episcopal churches as retain the right of ordination the ministers are ordained by the laying on of the hands of the presbytery.

As we have already noticed under BISHOP, the great controversy between Episcopalians and Presbyterians is the authority by which holy orders are conferred. The former hold that bishops alone are vested with this authority; and those especially who entertain the notion of apostolic succession—that is, assert the fact of an unbroken series from the days of the apostles to the present time, to which the power of ordaining ministers is confined, and through which it descends—deny the validity of orders, and even the existence of a church, where there is no

bishop. The Presbyterians, on the contrary, contend that the presbytery or body of clergy have authority for this purpose, and that bishops and presbyters are in Scripture the same, and not distinct orders or officers.

Many at the Reformation held the call of the people the only thing essential to the validity of the ministry, and taught that ordination is only a ceremony which renders the call more solemn and authentic; and at the present day some of the smaller Protestant sects dispense with the ceremony of ordination altogether.

ORDNANCE See ARTILLERY and GUN.

ORDNANCE SURVEY, the name given to a great national undertaking, embracing all the operations necessary for a complete trigonometrical survey of the United Kingdom, and the preparation of complete sets of maps and plans. In the rebellion of 1745, the want of accurate maps of the Highlands was severely felt by the government generals, and the following year a survey was commenced by Major-General Roy, an engineer officer, his maps being drawn up on a scale of an inch and three-fourths to the mile. He completed the drawings for a map during the periods between 1746 and 1755, but owing to political troubles these were never published. Soon after this date it was proposed to extend the survey to the whole kingdom, but it was not until 1784 that the work was commenced by Roy, who in that year commenced the measurement of a base line on Hounslow Heath, near London. Another base line was measured with steel chains in Romney Marsh, in 1787, and in 1791 the line on Hounslow Heath was carefully remeasured by General Colby. In 1794 the survey for a 1-inch map was begun, some sheets being published in 1796. The work was continued slowly and irregularly for a number of years from this period, three other base lines being measured for verification—viz., on Salisbury Plain in 1794; on Misterton Carr, near Doncaster, in 1801; and on Bellhalvie Sands, Aberdeenshire, in 1816. Some time after this, General Colby, the director of the Ordnance Survey, invented the compensation bars which bear his name, and they were used in 1826-27 in the measurement of a base line on the shore of Lough Foyle in Ireland, and again in 1849 for a remeasurement of the base line on Salisbury Plain. The base lines, from which all the primary triangulation has been carried on and the sides of the triangles calculated, are those on Salisbury Plain, 6·97 miles long, and at Lough Foyle, 7·89 miles long, and the accuracy of all the operations will be seen by the fact that the difference of the length of the base line at Lough Foyle, as actually measured and as calculated from the triangulation carried from the Salisbury base, was only 5 inches.

In 1809 the principal triangulation of Scotland was commenced, and the work was continued with many interruptions until 1823, when it was broken off, and beyond some detail surveying nothing was done until 1838. In 1821 the chief strength of the surveying corps was transferred to Ireland, a map of that country being urgently required. The survey, begun in that year, was completed in 1840—the maps, on a scale of 6 inches to the mile, being completed and published soon afterwards.

In 1838 the triangulation of Scotland was resumed, and the work was continued until the whole of that country had been surveyed. In 1810, when the survey in England had reached Yorkshire and Lancashire, the scale was increased from 1 inch to 6 inches to a mile. The work was continued steadily after this, but the authorities displayed such extreme indifference to the publication of the maps prepared, as to arouse after a time considerable discontent, and after a prolonged controversy in the public journals, a committee, appointed by the House of Commons, proposed stopping the issue of the 6-inch maps altogether, in order that the 1-inch maps might be issued as soon as possible. This recommendation gave rise to much discussion as to the respective merits of the 6-inch and 1-inch maps, and

ultimately, in 1854-55, another select committee was appointed to consider the whole question. This committee recommended that maps of the counties should be published on the 6-inch scale, and of the whole kingdom on the 1-inch scale. In addition, they advised that towns having 4000 or more inhabitants should be surveyed on a scale of $\frac{1}{25,344}$ of the linear measurement, which is equivalent to 126·72 inches to the mile, or 1 inch to each 41½ feet; and that parishes in cultivated districts should be mapped on a scale of $\frac{1}{25,344}$ of the linear measurement, equal to 25·344 inches to the mile, or 1 square inch to an acre. For the Highlands of Scotland and the moors and heaths of England, a 6-inch survey and a 1-inch map was deemed sufficient. After some hesitation, these recommendations were accepted by the government, and arrangements were made for carrying on the work on the lines indicated. By the Survey Act, passed 12th May, 1870, the Ordnance department was made one of the subdepartments of the Board of Works. The attention of the country and of Parliament was further directed to this subject in 1879 by the report of a committee appointed to consider the important subject of transfer and titles of land, and the government decided to increase the staff of the department in order that the work might be finished by the year 1890.

In carrying out the work of the survey, the primary triangulation is broken up into a secondary triangulation, whose sides are about 5 miles in length, and this again into the parish triangulation, with sides of about 1 to 1½ mile. The instruments used in the secondary and parish triangulations are 12-inch and 7-inch theodolites. These triangulations are carried on a little ahead of the actual detail survey. Every precaution that experience has suggested is taken to insure accuracy in every detail, and all the separate operations are performed by different persons, who therefore form a check upon each other. The original survey and manuscript plans are prepared on the $\frac{1}{25,344}$ scale, and when examined and passed copies are multiplied and printed by zincography. The 6-inch plans are now also produced direct from the manuscript $\frac{1}{25,344}$ plans by the process of photozincography. By this means a great saving in expense is secured, and a much greater saving in time, for a sheet, the engraving of which formerly took months, can now be produced in a few hours. The map on the 1-inch scale was formerly reduced by means of the pantograph, a tracing of the reduction being laid down on copper for the engraver. By a new process the 6-inch map is printed in light blue ink, and then the details required for the 1-inch map are marked in with black ink, a reduced copy being then taken by means of photography. This is used by the engraver, and as soon as the outline is completed a copper matrix is taken of the plate, and a duplicate copper plate made from this matrix by the electrotypes process. The contours are added on to the duplicate plate, and it is used for printing the copies which are sold in outline without the hill features. The town maps on the $\frac{1}{25,344}$ scale are produced by processes analogous to those of the 25-inch ($\frac{1}{25,344}$) scale.

In 1885 the 1-inch maps of the whole of England and Wales, including the Isle of Man, had been completed and published, the new railways opened during the year being engraved upon the plates. Of the new 1-inch map of England and Wales which is being prepared as the cadastral survey advances, the area published in outline was 18,184 square miles, out of a total area of 59,470 square miles. The total area of England published on the 6-inch scale amounted to 84,203 square miles, and the total area on the scale of 25·344 inches ($\frac{1}{25,344}$) amounted to 26,600 square miles.

Of Scotland the survey of the whole area, amounting to 30,902 square miles, has been completed, and 6-inch county maps for the whole have been completed and published. The area published on the 1-inch scale in 1885 in outline

was 27,621 square miles, and with hills 22,755 square miles. Of the cultivated portions of Scotland maps on the 25-344 inch scale had been published of an area of 12,687 square miles.

As already mentioned, the survey of Ireland was completed in 1840, and maps of the whole on a 6-inch scale were published. Since that period a revision has been proceeding, and 11,367 square miles have been re-surveyed on the same scale and the maps published, the area of the whole country being 32,813 square miles. The map of the kingdom on the scale of 1 inch to a mile has been engraved and published in outline. The sketching of the hill features has been completed, and the area published with the hills amounts to upwards of 25,000 miles.

Most of the large towns in the United Kingdom have been surveyed and plans of the majority have been published. For the most part these plans are on the $\frac{1}{2500}$ scale or 10-56 feet to a mile, but London is published in block, on scales of 5 feet 10 inches and 6 inches to the mile, and with details complete on scales of $\frac{1}{2500}$ and 5 feet to a mile. The other scales on which town plans are published are $\frac{1}{1250}$ or 10 feet to a mile, $\frac{1}{1250}$ or 5 feet to a mile, $\frac{1}{625}$ or 2 feet to a mile, $\frac{1}{312.5}$ or 20 inches to a mile, and $\frac{1}{156.25}$ or 12 inches to a mile.

The maps prepared by the ordnance survey, when published, are sold in sheets to the general public, and copies are supplied under certain regulations to public departments, public institutions, public libraries, government educational establishments, &c. Formerly agents were appointed by the department for the sale of the maps in all the principal towns, but since 1885 the agency for England and Wales has been placed in the hands of Messrs. Stanford of Charing Cross, by whom the trade and public are supplied. The maps on the 1-inch and 6-inch scales are published at prices varying from 1s. to 2s. 6d. per sheet, according to size and details, and the large-scale maps of cultivated parishes and towns are issued at prices varying from 2s. to 22s. per sheet, according to the amount of colouring. For general views of the structure of a country, its geographical features, and for travelling purposes the 1-inch map is the most valuable. The 6-inch maps are on a sufficiently large scale to allow every house and field to be clearly laid down, while they are invaluable for minute surveys of railways or roads, or the structure of rich mineral districts. Still more valuable are the cadastral plans on the 25-inch scale, and if any effective measure is carried through Parliament for the registration of titles and the simplification of the transfer of land, the existence of accurate official and readily procurable maps will be of the greatest service to the community.

It is also interesting to note that the process of photozincography, which was invented at the office of the ordnance survey in 1859, besides being used in the preparation of the ordnance maps, has been applied to the reproduction of a series of fac-similes of the most valuable of the National MSS. and several volumes have already been published. Most of the nations of Europe have produced or are busy with trigonometrical surveys, and some of the series of maps published are of great interest as scientific works. Outside of Europe the greatest work of this kind has been the trigonometrical survey of India, a gigantic task carried out with great ability and success. The coast survey of the United States, an immense undertaking, has been for many years in progress, and it is intended to continue the work until the whole of the territory of the republic has been included. In South America, Peru and Chili are the only countries which have been trigonometrically surveyed.

ORDOVIAN or ORDOVICIAN, in geology, a term proposed by Professor Lapworth to include the old Palæozoic formations between the Arenig beds and Bala beds inclusive. This series is otherwise classed simply as Lower

Silurian [see GEOLOGY] or as Upper Cambrian, according to the views of the respective authors.

ORE, the hundredth part of the *krone* in Norway, Sweden, and Denmark; its value being about an eighth of an English penny. Silver pieces of ten, twenty-five, and fifty ore are struck.

OREGON, one of the United States of North America (admitted to the Union on the 14th February, 1859), is bounded north by the Columbia River, which separates it from Washington territory, south by Nevada and California, west by the Pacific, and east by the territory of Idaho. It is about 340 miles from east to west, and 280 from north to south. The area is 95,000 square miles, and the population in 1884 was 174,167.

The Coast and Cascade Mountains traverse Oregon from north to south in the west, and have many lofty summits, among which is Mount Hood, in the Cascade range, 11,225 feet high. The climate is mild and moist on the coast, but severe in the highlands. The central portion of the state affords excellent pasturage, but the upper or eastern country is sterile, owing to the arid soil and variable climate. Gold, silver, copper, platinum, iridium, osmium, and coal are found. Indian corn does not succeed in any part, from deficiency of rain. The valley of the river Willametty, which is extremely fertile, is about 150 miles long and 60 miles broad. Oats, potatoes, and apples are also grown.

The Columbia River rises in the Rocky Mountains, in 50° N. lat., 116° W. lon. It flows first north by west and then south by west to Fort Colville, where it is 2049 feet above the sea-level, having fallen 550 feet in 220 miles. Thence it flows west 60 miles, and then south 160 miles to 45° N. lat., where it is 1286 feet above the sea-level and 3500 feet wide. From here it flows 80 miles to the Cascade Mountains, through which it passes in a series of falls and fine rapids. The river afterwards continues its course west 160 miles to the Pacific Ocean. It receives the Willametty, the Fall, and the Snake or Lewis rivers, and many smaller tributaries. Its entire length is about 1200 miles. The entrance at the mouth is rendered dangerous by sandbanks, but it is navigable for 100 miles, and improvements to the entrance have been made. Near the head of this river, in British Columbia, gold was discovered in 1856. By the Oregon treaty its entire navigation is open to British vessels. There are many small lakes in the south of the state.

Oregon has vast forests of pine, a gigantic species (*Lamberti*), in the lower region, attaining to a height of 300 feet and to a girth of 40 feet. Next to fir, oak is the most valuable timber. The wild animals are the black and grizzly bear, deer, antelope, elk, fox, wolf, beaver, and marten. The rivers swarm with salmon, large quantities of which are exported to the United Kingdom.

Formerly the name of Oregon was given to the whole territory west of the Rocky Mountains claimed by the United States. In 1845 a dispute respecting boundaries arose between the government of Great Britain and that of the United States, but it was settled by treaty in the following year. The present state was constituted as a territory in 1848, and was admitted as a state in 1859. The capital of the state is Salem.

OREIADS were the nymphs or patron-goddesses of mountains and grottos in the classical mythology. See **NYMPHS**.

OREL, the chief town of a government of the same name in Russia, is situated on the river Oka, where it is joined by the Orlik, 238 miles S.S.W. of Moscow by rail. The houses are in general of wood, and the interior of the town is gloomy. The population is about 40,000. Orel is well situated for trade, being connected by rivers and canals with the Baltic, Black, and Caspian seas; it is the entrepôt for the corn of Little Russia, and the place from

which Moscow draws its chief supply. Besides the buildings belonging to the crown, there are numerous churches, two convents, a gymnasium and other schools, and a bazaar. The town, which is defended by an ancient citadel, has manufactures of cotton, woollen cloth, linen stuffs and ropes, and tanneries and distilleries, and several important annual fairs. It was nearly destroyed by fire on the 7th June, 1848.

OR'ENBURG, formerly the capital of a government of the same name in Russia, is situated in a vast plain at the conflux of the Sakmara and the Ural; it is of an oval form, pretty regularly built, and well fortified. The population amounts to 35,000. There are two cathedrals and several Greek churches, a Tartar mosque, Lutheran church, exchange, custom-house, museum, a military academy for eighty pupils, a great European bazaar with 180 shops in the town, and an Asiatic bazaar with 492 shops in the Kirghis territory, a league from it, which is the depot for the merchandise of Central Asia and of Russia. The trade with the former is extensive, the imports consisting of silk, gold and silver, Chinese produce, and colonial goods received overland from India; and the exports comprising woollen cloths, leather, pearls, cutlery, &c.

OR'EODAPHNE (Mountain Laurel), a genus of plants belonging to the order Lauraceæ. *Oreodaphne opifera* is a native of the woods of Para and the Rio Negro. A volatile oil is distilled from the succulent fruits, which is used in Brazil as a remedy in pains and contractions of the limbs. The oil, obtained by incisions in the trunk, is applied to tumours. The species belonging to this genus are large trees, with alternate leaves and clusters of flowers, which are generally unisexual and dioecious. The six-lobed limb of the perianth falls away when the flower is over, and the tuber increases and surrounds the base of the fruit. There are three series of fertile stamens, three in each series, and sometimes there is a fourth internal series of barren stamens. The style is short and bears a disc-like stigma.

OR'EODOXA, a genus of feather-leaved PALMS, to which belong the *Oreodoxa oleracea*, or West Indian cabbage palm, an esculent vegetable, whose young leaves, when boiled, make an excellent dish. From the pith a kind of sago is obtained, and oil is expressed from the fruits. The trunk rises to a height of 170 feet, and the leaves are so large that as they fall the lower part of the stalk is cut away and is used by the negroes as a cradle. The greater portion of the stem is soft and pithy, and the wood, though hard, is so small in quantity, and so narrow, that it is only fit to be cut up into walking-sticks or made into ramrods. *Oreodoxa regia* (the royal palm) is, like the last species, very elegant and majestic in form. In Miss North's Gallery at Kew there is a painting of an avenue of these trees in the Botafogo Botanic Gardens in Brazil. This avenue is half a mile long, and is composed of trees which were only planted 100 years ago, and yet have already attained the height of 100 feet. One leaf is as much as a man can carry. Five leaves fall every year, each leaving a scar in the form of a ring round the trunk. "The great peculiarity of this tree is, that there rises upon the rough part of the trunk a grass-green, smooth, thinner shaft, like a column placed upon a column, and from this the leaf-stalks spring" (Seemann). In this genus the flowers are unisexual and surrounded by small bracts; the flower-spikes are inclosed in double spathe, which are somewhat woody in texture.

ORES. Metals are rarely found in nature in the pure or metallic state, but in that of ores; that is, chemically combined with certain mineralizing substances, which completely disguise, and in fact, till separated by metallurgical processes, destroy their usually recognized and useful properties. The most important of these mineralizing bodies are oxygen and sulphur; the next in rank are chlorine,

and the sulphuric, carbonic, and phosphoric acids. And it is interesting to note that M. Dieulafoy has lately (1885) pointed out how the commonest ores of any particular metal are precisely those compounds which require the greatest expenditure of heat when their constituent elements are entering into chemical combination. See copper ores, IRON ORES, &c., under their respective headings; also MINERAL DEPOSITS and MINES.

ORESTES, in the Greek heroic mythology, was the son of Agamemnon, by his queen Klutimnestra, and brother therefore of Iphigenia and Elektra. When Agamemnon was slain by his guilty queen and her paramour on his return from the Trojan War, Orestes was thought to have been slain too, but the devotion of his nurse led her to sacrifice her own child to preserve the prince. He was secretly conveyed to Strôphios, king of Phôkis, who had married the sister of Agamemnon. Orestes and the king's son (and his own cousin) Pylades (Lat. *Pylades*) contracted a friendship so great that it passed into a proverb. When therefore, as Orestes grew up, he received message on message from his sister Elektra, urging him to avenge their father's murder, Pylades accompanied his friend in the fatal expedition. Aigisthos, the queen's paramour, and Klutimnestra herself, fell by the hand of Orestes; but although the oracle at Delphi had urged him on to the deed, the Furies, enraged at the murder of a mother, drove him over the land in a state of madness. The god Apollo, to whom he fled for aid in his trouble, advised him to bring to Athens as a votive offering the image of the goddess Artemis, which had fallen from heaven on the shores of the inhospitable Tauris (Crimea). They no sooner landed there than the friends were seized upon for sacrifice to the goddess, according to a barbarous custom of the country. The astonishment of Orestes was great at finding the high priestess of the goddess to be his own sister Iphigenia, not dead as was supposed, but preserved thus by favour of her patron goddess. By skilful stratagems Iphigenia managed to preserve her brother's life and his friend's, and to carry off the goddess's statue with them. Orestes now recovered, Iphigenia founded a shrine for the image and became its priestess. Pylades married Elektra, and Orestes, restored to his father's kingdom, and now a powerful prince, was able to conquer his promised bride, the daughter of Helena of Troy, Hermione, whom Neoptolemos (son of Achilles) had seized upon in the days of his weakness.

ORFILA, MATTHIEU JOSEPH BONAVENTURE, a distinguished physician and toxicologist, was born at Mahon, in the island of Minorca, 24th April, 1787. He studied at the University of Valencia, where he made such progress that the Junta of Barcelona sent him at their own expense to Paris to complete his education, on condition of his returning to fill one of the chairs in their medical school. He arrived in Paris in 1807, but was breaking out between France and Spain his annual allowance ceased, and he was indebted to Vauquelin, the chemist, for permission to remain at Paris, and to an uncle established at Marseilles for his support, until the period of his graduation. At the expiration of his studentship he passed a brilliant examination, and obtained the degree of Doctor of Medicine. He then began to lecture privately on chemistry, forensic medicine, and anatomy for his support, and at the same time commenced those researches on toxicology on which his fame chiefly rests. In 1819 he was appointed professor of medical jurisprudence in the University of Paris, and in 1823 he succeeded Vauquelin as professor of chemistry. In 1830 he was nominated dean of the Faculty of Medicine at Paris, a high medical honour in France, and under the Orleans dynasty he gained honours and wealth in abundance. As dean of the Faculty of Medicine he introduced various and great reforms, among which was the foundation of preparatory schools of medi-

cine in the principal large towns. He also so enriched the anatomical and pathological museum of the faculty that his name was attached to it by the government as a lasting memorial to his honour. The revolution of 1848 deprived him of all his appointments except his professorship, and this blow, with the illness of a son, preyed upon his health. He died after a short illness, 12th March, 1853.

His principal works are the treatises on "General Toxicology" (1813-15); "On Chemistry" (1817); "On Medical Jurisprudence" (1823); and on "Medico-legal Exhumations" (1836). Of these the first is the most important, and it is a vast mine of information obtained by personal, experimental, and indefatigable research on the part of the author. It includes a notice of the symptoms of poisoning of all kinds, the internal appearances to which poisons give rise, their action upon the system, and the means of their detection. In addition to the works mentioned, Orfila contributed numerous separate papers to medical literature, and at his death left behind him a number of memoirs which had not been published.

ORGAN. The organ is sometimes called the "king of instruments," and when the grandeur and the immense variety of its effects, the ingenuity of its construction, the unlimited skill which may be used by the performer upon it, and the vast field at the disposal of the composer for it are considered, the epithet is not so ill-deserved.

History of the Organ.—There is no doubt of the origin of the instrument, although it has now attained proportions so complex as to forbid our article, by considerations of space, from undertaking more than a glance over a few of the main features now found in an organ of the first class. In such organs the performer is aided by the power of steam or gas or water engines, by compressed air, and by electricity, in his task of compelling to his use four or five rows of keys for the hands, and one for the feet, operating on a forest of pipes to be counted by the thousand, and controlling a volume of sound ranging from an almost inaudible whisper up to a roar which threatens to burst the ear drums. The humble origin of this magnificent instrument was the extremely ancient syrinx, the familiar Pan's-pipes of the travelling showman. The schoolboy who makes day hideous by blowing into the pipe of a door-key imitates some forgotten Aryan ancestor who began the syrinx by cutting a reed from the river's brink, and blowing into it against the sharp edge. The breath being thrown into a vibratory flutter would be compelled to vibrate at one fixed rate, varying according to the dimensions of the pipe, and would give out a musical tone. [See *Acoustics*.] The most savage nations known to us have discovered that a longer pipe makes a deeper sound, and a shorter pipe a shriller sound.

Our ancestor would also quickly find out that a reed cut at a knot, and therefore stopped at one end, would give a deeper sound than one open at both ends. We know now that a stopped pipe of any given length sounds (within a small discrepancy) the octave beneath an open pipe of the same length. For instance, one of the Pan's-pipes (which are stopped) sounds an octave beneath a flute of the same length. As the reed cut at the knot originated the Pan's-pipe, so did the reed cut between the knots originate the flute. The Siamese court-band which performed at the Inventions Exhibition of 1885 had in use such flutes, mere open tubes blown at the end, the sharpened edge serving as the wind-cutter and vibration-producer. From this primeval flute, which pictures painted 3000 years before Christ tell us was known to the earliest Egyptians, two divergences have branched. Stopping one end and blowing directly at the edge of a hole in the pipe near the stopped end gives us the flute proper; stopping one end and blowing at a similar edge not directly (or sideways), but through a narrow slit in the stopping (or lengthways), gives us the whistle, the flageolet, and the organ-

pipe. Except for the reed-pipes the organ is simply a huge box of whistles, some open and some stopped. The theory of the motion of air and the consequent production of musical tones in these ORGAN-PIPES is dealt with in the article of that name: and the theory of the reed-pipes is treated in the article REED INSTRUMENTS. The origin of the latter is yearly exemplified by the urchins who make at every harvest-time squeakers from wheat-straws (or better still from oat-straws) with undiminished joy.

The same Egyptian wall-pictures, now close upon fifty centuries old, which tell us of the antiquity of the flute, tell us of the smith's bellows; and we may be sure that at a very early period the idea of sounding pipes by a mechanical supply of wind produced somewhat in this way would occur to ingenious minds. The simple device of two blowers alternately filling a wind-chest by blowing with the mouth, and resting to take breath, was no doubt the first to be tried. That this is not an *a-priori* guess is shown by an interesting bas-relief preserved in the museum at Arles, the ancient Roman town of *Arelate*, and figured in the first Plate accompanying this article. The performer on the other side of the instrument (the largest or bass pipe being, of course, to his left) would find slides in front of him, which, when pushed in beneath the ends of the pipes, would stop such pipes as were not required to sound. (If there were no slides the whole group of pipes would, of course, sound at once.)

But this instrument, though no doubt the earliest to originate, was as regards the Arles specimen a late survival from ruder ages; for long before the presumed age of this monument (first century B.C.) organs were blown by bellows. It was found difficult, even with two bellows, to keep the supply of wind constant and uniform, and the "Pneumatic Organ" gave way about the middle of the third century B.C. to an invention of Ktesibios (in Latin *Ctesibius*). He was a philosopher of Alexandria, who had risen from the trade of an ordinary barber to be one of the foremost teachers of his day. This invention of Ktesibios was the HYDRAULIC ORGAN, and in the article of that title an account of it will be found; wherein the desired equal pressure of wind will be seen to be gained by utilizing the weight of water in a large chamber, all air compressed beyond a certain degree of density being allowed to escape. Thus a constant stream of wind at a constant pressure was supplied to the organ, no matter how intermittent the supply from the bellows. In the organ of Ktesibios air-syringes and not smith's bellows were used as the source of air, but that is an unimportant detail. With modifications the "hydraulic organ"—not a very accurate designation—flourished long; and was used even down to the thirteenth century, when the improvement of the wind reservoir of the "pneumatic organ" quite drove it out of existence. It was only the want of such a reservoir which had crippled the pneumatic organ. (How great this want must have been can be realized in the easiest manner to-day by any one who will play on an ordinary harmonium with the *expression stop* drawn, and who will assuredly find the greatest difficulty in keeping a steady wind, if the stop annuls, as it should do, the action of the reservoir, so that the performer may be said to be blowing directly upon the vibrators of the instrument.) Such an ancient organ without reservoir is sculptured on the pedestal of the obelisk which the Emperor Theodosius erected at Constantinople, towards the close of the fourth century of our era, and as it is the earliest example of the kind it is figured in our first Plate. The blower-boys operate the two bellows by standing on them, one on each, alternating their action so that both bellows are not being blown at once. The sculptor, ignorant or contemptuous of perspective, has failed to make this alternation clear. The method of blowing by the sheer weight of the human body remained in vogue for centuries; for in Plate II. will

be found a specimen of an organ built in the middle of the fifteenth century and existent in use not more than 250 years ago, where men blow pairs of bellows, one foot down and the other up, putting their feet into a kind of shoe upon the upper boards. Or the two bellows might be worked by hand, as in the illustration in Plate I. from a MS. of the time of Charlemagne. In this sketch the slides spoken of in describing the Arles bas-relief are well seen, and the organist is in the act of pulling or pushing them.

The first use of the organ in the services of the church is attributed to Pope Vitalian (657-672), the same pope who forbade congregational singing. (This pope is also particularly memorable to Englishmen, as he, by appointing Theodore of Tarsus Archbishop of Canterbury, was the means of first organizing the English Church.) A century later we read of the gilded and ornamented pipes of the church organs in England, showing how rapidly our forefathers, with their national love of music, had appreciated the grandeur of the instrument. Soon after, the Frankish Chronicles record an application for an organ on the part of the Frank king Pippin to the "Roman" Emperor of the East (757), and the emperor's gracious granting of that request. The next Frankish king, Karl the Great (Charlemagne) first Emperor of the Western or "Holy Roman" Empire, caused a copy of his father Pippin's organ (pneumatic) to be made for Aix-la-Chapelle (812), and thus introduced the organ into Germany. Karl's son and successor in the empire, Ludwig (Louis), also caused an organ to be made in Aix-la-Chapelle (822). This was a hydraulic instrument with leaden pipes. No doubt many others were made that we do not hear of, and the art progressed rapidly in Germany, for in 880 the Pope himself, desiring an organ, sent to Germany for it. Nor were the English idle in the new art. St. Dunstan (925-988) was a great patron of it, and worked at organ-building with his own hands, in his earnest zeal for the advancement of the church. An English organ of this period is shown in Plate I., copied from an illuminated psalter of the tenth century, preserved in the Library of Trinity College, Cambridge. The blowers appear to have let the wind sink, and are being reproved by the organists. The mode of playing is obscure, the fingers of the organist apparently coming through the pipes. The marks in front may perhaps be escape holes, silencing the pipes when not stopped by the finger, or they may be for a second row of pipes. The barrels beneath are probably hydraulic wind-condensers. The great organ at Winchester Cathedral at this time (950) had 400 pipes, and required seven blowers to supply it with wind, two organists being needed to manipulate its "two alphabets."

The organs during this early period often had more than one row of pipes. Their compass was not usually much beyond an octave, perhaps reaching to two octaves in large instruments, and it is evident that an organ like that of Winchester with its 400 pipes must have had something like twenty pipes to each note of each "alphabet" or manual. The pipes belonging to one note all sounded at once when the slide was pulled out, and all ceased at once when the slide was pushed in. The next step was to substitute valves for slides. About the end of the eleventh century we hear of the first arrangement of this sort in the organ of the Cathedral of Magdeburg, which had a compass of sixteen notes, and many pipes to each note. The several rows of pipes stood in lines behind one another, as at present. Beneath each pipe was a pallet, stopping the wind from passing into it and thereby making it sound (see the illustration of an eleventh century wind-chest, Plate II.) From each pallet, passing through the "wind-chest" (the cavity which then as now contained the "wind" supplied to the pipes from the bellows), and hanging out beneath it, hung down a cord, ending in a loop. Each key passed through the loops of a whole row of these pallet cords, so that when the key was depressed all the pallets of that

note were pulled down by their cords, attached at different points along the key, and all the pipes of that note sounded, that is, one pipe in each stop, throughout the whole organ. Springs were fixed beneath the pallets, so that when the key was released the springs closed the pallets (as they do to this day), and the pipes then ceased sounding. This was an enormous improvement on the slides, some of which had to be pushed in by the organist at the same time that others were being pulled out, with never ending confusion and delay. But at the same time, before the organ would speak, the considerable pressure of the springs in the wind-chest closing the numerous pallets, to say nothing of the wind pressing with elastic force against them, had to be overcome. The first keys therefore were ponderous levers 3 to 5 inches wide at least, an inch and a half thick or more, and a yard or so long, moving up and down several inches. The organist is called in old MSS. the "organ-thumper" (*pulsator organorum*), and his function was to strike with the fist the great levers serving him for keys. In the eleventh and twelfth centuries each note played an organum (mixture) of prime, fifth, and octave, &c., and the whole "full organ" was of course, owing to the construction given above, always sounding. To avoid this monotony of noise, a second and softer manual was presently added; and a few keys for the feet (pedals) were sometimes introduced to assist the bass notes. Such a construction is found in the Utrecht organ of 1120.

The earliest authentic drawings of organ keys are those in the "Syntagma Musicum" of Praetorius, in the supplement of illustrations to that work called "Theatrum Instrumentorum" (Wolfenbützel, 1620). Here the two manual keyboards of the Halberstadt organ, built in 1361, and the pedal keyboard added in 1495, are engraved, and the principal manual is shown in our Plate II. This manual has five chromatic notes; the second manual, of long straight keys, and the pedals, of the same scale as the manuals, have four (the *b* being omitted); we thus find ourselves approaching melodic performance upon the organ, and all the glory of "flats and sharps."

The fifteenth century was indeed the century of invention for the organ. First, the pregnant idea of shutting off rows of pipes, or letting them come into action, by means of transverse slides, was hit upon; this gave variety to the body of tone. Next a certain Timotheus, a German workman, invented the present construction of sound-board grooves and wind-chest, but with an important difference which must be briefly adverted to. The old wind-chest received the wind from the bellows; and since the ends of the pipes fitted into its roof the wind passed up directly into them. Then came the invention of the pallet or valve beneath the end of each pipe, as before explained. The invention of Timotheus was to glue beneath the roof of the wind-chest long strips between the rows of pipe-holes, which strips or partitions hung downward and divided the whole wind-chest into grooves, extending from front to back. It is clear that each groove would contain all the pallets beneath the pipes of one note, i.e. one pipe out of every row (or stop) of pipes in the organ. Timotheus put a second unpartitioned wind-chest beneath the first or partitioned one, and pierced the roof of the second wind-chest (which was at the same time the floor of the grooved wind-chest) with large holes, one to each groove; these holes he covered with pallets, which were opened by keys as before. But this great difference had been made, that each key of the organ now only opened one pallet, and the touch became light and manageable in consequence. The construction can be understood on reference to the sections in Plate II. When the key opened the pallet the wind was admitted to the whole groove above, and was ready to sound all the pipes of the note. But (and here the modern section deviates in construction) it will be remembered that these pipes were stopped from sounding, each one by its own pallet, as shown

in the eleventh century wind-chest figured in the same Plate. Now each of the pipe-pallets had a stem fitted to it by Timotheus, projecting *upwards* through the sound-board (the name now given to the old wind-chest in its partitioned or grooved condition), and it was not difficult to arrange mechanism such that, a handle being drawn out, all one row of stems from side to side, that is, through the whole compass of the organ, should be depressed, and the pallets of that row (or stop) thus opened in all the grooves at once. All the notes of that row (or stop) of pipes were now open for sounding, but they nevertheless did not all sound, because wind could only reach those grooves of which the keys were depressed by the organist. The touch of the keys was lightened most wonderfully, but the handles (or *draw-stops*) controlling the rows of pipes by means of their projecting pallet stems had still to fight against all the springs of the pallets of the row, and were very heavy to draw; moreover they had to be fastened while they were required to be drawn out, for when they were released the strength of the pallet-springs soon drew them in again. This construction remained long in vogue, and was called the *spring sound-board*. The keys were still broad, though not so broad as before, and the general appearance of an organ of the period is well shown in the illustration from Gaffurius in Plate II. The keys now becoming narrower, the pedals no longer matched them in scale, and the roller-board was shortly afterwards invented, since the old direct action (by cords pulling down the keys) was no longer possible. Rollers of wood, with metal pins or arms inserted, permitted force to be applied at one part and transferred to another, either to the right or left as desired, the action being continued in the same direction when the arms are both on one side of the roller, and reversed in direction when the arms are upon opposite sides, as shown in Plate II. (Iron rollers are now more generally used, as being sure, rigid, and taking less room.)

Now the only main distinction between the mediæval construction and that of to-day, as shown in the sections in Plate II. is, that instead of the stop-action of Timotheus we have reverted to the use of slides. Their use began during the sixteenth century. A modern organ has a stratum of slides interposed between the *upper-board*, in which the pipes rest, and the *table*, which forms the roof of the sound-board; the slides run across the organ from side to side, *i.e.* from treble to bass, one slide beneath each entire stop. For each pipe in the organ a hole is bored through upper-board, slide, and table right into the groove of the sound-board beneath. It is manifest, therefore, that when this has been done and the slide is afterwards drawn aside, its series of holes will no longer correspond to those of the table and upper-board, and the wind cannot pass from the groove to the pipe. See the cross-section in Plate II.

Pedals, almost as we now have them, were used by Bernhard the German (*Bernardo il Tedesco*) for the Doge at Venice in 1470, and even two years before that an octave of pedals was fitted to a Nuremberg organ (St. Sebald's) by Traxdorff. But it has been seen that the idea of playing the organ with the foot is at least as old as 1120 (Utrecht), though no doubt the first really useful form of pedals was due to these men of the close of the fifteenth century. Pedals still remained for centuries unknown in England. Small portable organs, of a few treble pipes, called *regals* [see Plate I.], became household favourites at this time. They are described in greater detail in the article *REGAL*.

Finally, stopped-pipes and reed-pipes, and variations in shape (inducing variations in the tone) of the hitherto always cylindrical metal open pipes, and of the hitherto always square wooden pipes, were other improvements adopted in this century, and by these means variety of quality as well as variety of force at last became obtainable upon the organ.

Independent pedal-pipes were now also added, so that the pedals did more than simply draw down the keys of the manuals; and pipes of 16 feet and more were made. The wind-supply was necessarily increased. Prætorius speaks of twenty pairs of bellows for the fifteenth century organ in the church of St. Ægidien in Brunswick, already referred to. [See illustration in Plate II.] The compass of the keyboard was increased to four octaves, but with only twenty-seven notes instead of twenty-nine. The lowest octave was a short octave, ending apparently on E, but really sounding C F G A B instead of E F G A B. The missing notes D and E were put upon the apparent F \sharp and G \sharp keys, and those notes were left out; B \flat alone remained. In some organs the keyboard even stopped at B; and G was put upon the B key, A upon the C \sharp key, the rest as usual. Many persons must have come across some of these curious old "short octave" organs, for the style was used by both Renatus Harris and Father Smith, the two great rivals after the Restoration, who worked, when all the English churches needed organs at once, to repair the ravages of the Puritan organ-breakers. Indeed, short octaves were not infrequently used in small organs during all the eighteenth century.

Wonderful as are the benefits which England received at the hands of the Puritans, all the artistic and joyous side of life was so ruthlessly crushed out that in many things the trace of their iron heel is still felt among us, to our great national loss. In nothing were they more monstrously bigoted and ignorant than in their treatment of the externalities of religious worship. Nearly all the old stained glass of England disappeared, and nearly all the old organs were chopped up and burned or melted. The whole musical history of England was cut asunder by this ruthless breach, and antiquaries now painfully grope out solutions to questions of moment which, had our forefathers been more liberally minded, need never even have been put. One instrument here and there was preserved; for instance Cromwell himself, of too noble a character to be a mere ruthless destroyer, preserved the fine two-manual instrument of Magdalen College, Oxford (thirteen stops), built in 1637 by the first of the celebrated Harris family (grandfather of Renatus Harris), by removing it bodily to Hampton Court Palace in 1654—where it remained till 1660. (In 1737 it was removed to Tewkesbury Abbey, and the diapasons of the great organ and the principals of both great and choir still exist there, one of the rare relics of pre-Commonwealth times.) On 23rd August, 1643, the Parliament, now supreme in authority, passed a rigid ordinance for abolishing superstitious monuments, which they strengthened by a further ordinance on the 9th of the following May, containing this clause, atrocious to every musician in its bald merciless Philistinism:—"That all organs, and the frames and cases wherein they stand, in all churches and chapels aforesaid, shall be taken away and utterly defaced, and none hereafter set up in their places." The list of those instruments which escaped destruction in consequence of this edict is very scanty. The cathedral organs of St. Paul's, York, Durham, and Lincoln, and the college organs of St. John's and Magdalen, Oxford, and of Christ's, Cambridge, are among the few that are known with certainty. The organ-builders were all dispersed, died, or took to other trades for a living. When Charles II. came back, and somewhat of the old state of things was restored, most of these men no longer knew their trade, and bitter complaints were made later on of the havoc they wrought in their ignorant attempts to patch together the remnants of the old instruments, which more skilful hands might have brought together again and saved. The Dallans (some of whose large wooden pipes still remain in King's College Chapel organ, Cambridge) and the Harrises, who returned with the king from exile, were almost alone in competency. In this emergency the king

offered liberal inducements to foreign builders to settle in this country; and the chief of those who responded to the invitation was Bernhard Schmidt, better known to us as Father Smith, who was named "Organmaker-in-ordinary to His Majesty," and who, with his two nephews, took nearly all the best work of the time. Quarters were allotted to him in Whitehall Palace. Later on Renatus Harris became a worthy rival to Father Smith; but in the beginning the many novelties that Smith brought with him placed him beyond comparison. Reed stops, mixtures, and double diapasons were at once heard for the first time in England, and a third manual ("Echo," *i.e.* *echo*) was introduced. This operated upon a few rows of pipes inclosed in a box by themselves, so that the tone was distant, echo-like, and soft. An interesting contest took place over the organ in the Temple Church between these two great builders; for each one was allowed to erect an instrument of about a given size within the church, the learned benches agreeing to take that which after trial they preferred. Both were admired, but Smith carried the day by unanimous consent (21st June, 1688).

In 1710 Renatus Harris first made an organ with four manuals (two greats, choir, and echo) for Salisbury Cathedral.

The first swell recorded is that used in St. Magnus' organ, Southwark, by Jordan, in 1712. Jordan took the old echo-box and fitted it with a shutter, like the sash of a window. The organist, by pressing a pedal raised the shutter, and on releasing it the shutter fell, too often with considerable noise. The effect was usually a sudden increase of tone rather than the desired swell. It was half a century before this old "Nag's head" swell (so called from the shape of the lever of the shutter) was superseded by the "Venetian swell" of G. P. England, deriving its name from its resemblance to a Venetian blind, for it is inclosed by several narrow shutters hung on horizontal axes. The swell-pedal causes these shutters all to rotate simultaneously, and so to open the swell-box to any extent desired; the deeper the pedal is depressed the wider open swing the shutters, and when the pedal is released the shutters close by their own weight. Precautions are taken against sudden and noisy closure. To complete the account of the swell it may be added here that within the last few years the swell shutters have been hung upon vertical axes, so that they do not tend to close by their own weight, but remain at any opening, giving in consequence any desired quantity of tone for so long as they are undisturbed—a valuable additional quality to the power of crescendo. This last they possess equally well with the older Venetian swell of horizontal shutters. The swell pedal in this construction is centrally balanced, depression by the toe (of the inner half) opening the swell, depression by the heel (of the outer half) closing the swell; and the pedal will remain steady at any angle if the foot is withdrawn. To remedy the inconvenience of the loss of one foot in pedalling when it is engaged with the swell pedal various devices have been tried. Movable backs have been fitted, so that the organist can move the swell pedal by leaning back in his seat, and pneumatic tubes, so that he can work it by the breath, &c. The solution of the difficulty has not yet been obtained. Returning to the point at which we digressed, the early part of the eighteenth century, Jordan's invention of the swell was at once eagerly welcomed, and applied by many builders. The octave coupler soon followed (St. Mary Redcliff, Bristol, 1726). Handel's organ, in the Foundling Hospital, built by Parker in 1749, was a praiseworthy attempt to utilize the "mean-tone temperament," by which system of tuning a few scales or keys were sweetly set in tune to the detriment of the rest. (The object was sought to be effected by four extra pipes in each octave, so that drawing a stop would make the C♯ key sound true D♭ or the D♯ key true E♭, and the G♯ and A♯ keys sound true A♭ and B♭.) Handel's remedy has,

however, been found inefficient beside his great rival's; and the system of equal temperament, wherein all keys are tuned exactly alike, each key being slightly out of tune, which was introduced at this time by the immortal Bach, now universally prevails.

The century closed worthily with the improvement of the swell as narrated above and the adoption of pedals, which, though long used abroad, had never before gained a footing in England. The first set of pedals certainly known to be made in England, were fitted by G. P. England (inventor of the Venetian swell), at St. James', Clerkenwell, in 1790, and were of one octave compass only. For some time the new keyboard was called

German pedals," a token of its foreign birth and strangeness. But English organ-builders, who had already invented the highly important swell, now carried on their improvements swiftly and honourably. The invaluable device of composition-pedals was due to Bishop in 1809, and the same clever builder cured a long-standing difficulty of unsteadiness of wind on any sudden demand of wind on the part of the heavy bass pipes, by his concussion bellows in 1825. The pneumatic lever (to be presently described) was due to an idea of Booth of Wakefield, in 1827, and being carried to a workable practicable form by Barker at York in 1832, was first applied to a complete organ by Cavallé-Coll of Paris in 1841, and at once then adopted for every instrument of large size, Willis taking the lead from the first. Radiating pedals were due to Hill (York Minster, 1834), and radiating-concave pedals to Dr. Wesley (St. George's Hall, Liverpool, 1844, Willis being the manufacturer), the object in each being to facilitate the pedalling from end to end of the organ. Mr. Barker, of pneumatic lever fame, following up a luminous idea of Dr. Guinlett's in 1851, first applied electricity to organs (in a way presently to be described) in 1867 at Paris, and the merit of the immediate introduction of this new agent of force into organ action work in England is due to Bryceson Brothers of London (Her Majesty's Opera, 1868, an organ afterwards long exhibited at the Polytechnic Institution, and now in New Malden Church, still working unimpaired by time), who have ever since been the chief manufacturers of electric organs. Pneumatic movements, on the other hand, remained chiefly with Willis & Son, who used the force of compressed air, not only to lighten the touch, but to convey motive power to distant parts of the organ. First, in 1861, they freed the right foot of the organist, so often occupied with the swell-pedal, by enabling the organist to operate the pedal quite easily with his breath, blowing down a flexible tube. Organists have, as a rule, not adopted this arrangement. The principle of pneumatic tubular transmission thus brought into practical operation, the same builders used it for superseding the old distance-movement by long trackers (always liable to get out of order), in St. Peter's Church, Blackburn (1865), Alexandra Palace (1868), the great Albert Hall organ (1870), &c. Their finest achievement in this way is their magnificent organ at St. Paul's (1872), which is completely divided by the width of the chancel, and is worked by tubes of compressed air. Some details of pneumatic actions are given later on. Steam-engines have been applied to the work of blowing large organs, but they are now usually superseded by the practically noiseless hydraulic engines, such as those of Joy, Duncan, or Blennerhassett. These are inexpensive, and serve also for small organs. A full description of such an engine, with illustrations, will be found in *HYDRAULICS*.

Principal parts of a Modern Organ.—Incidentally, in describing the spring sound-board of Timotheus, the division of the sound-board by partitions ("sound-bars") into long and narrow grooves, one to each note of the compass, and running from front to back, at right angles, therefore, with all the sets of pipes, was spoken of. The section "back to front" in Plate II. shows one of the partitions

seen lengthwise, and the section "across wind-chest" shows three of the partitions seen in section. To avoid confusion the term wind-chest is here restricted to the lower part, or what is by organ-builders called the *well*, and does not include the sound-board grooves, which by organ-builders are also held to be a part of the wind-chest. Above the grooves is seen the table, which is separated from the upper board by the slides—table and upper board being stationary, and being pierced with holes exactly corresponding to one another. Into the holes of the upper board the feet of the pipes are inserted, the bodies of the pipes being vertically supported and ordered by racks (not shown in the diagram). In the section from back to front, four pipes of stops of various sizes and qualities are shown; in the cross-sections two pipes of the same stop are figured. Four slides, one beneath each stop (row of pipes), appear in the section from back to front, and a part of one slide is shown in the cross section, one of which has the slide "on" (the stop being then ready for playing) and the other "off." The wind being supplied at uniform pressure from the bellows, fills the wind-chest and presses upon the pallets which close the grooves, and which therefore bar the way to the pipes. It is the function of the key governing any note to draw down the corresponding keyboard pallet (which, when released by the key, is returned to its place by a spring within the wind-chest), and by drawing it down to admit the wind to the groove, and therefore to all the pipes of various sizes and qualities which stand over that groove. The slides of the various stops now interpose between the wind which fills the groove and the pipes (one pipe of each stop) above that groove, and only those slides which are drawn allow the wind to pass to their pipe. Thus if one slide only be drawn, one single pipe will be permitted to speak, out of perhaps ten or twenty upon the sound-board groove, while if all the slides be drawn the whole of the various pipes of that note will be sounding at once. A simple organ action is shown in the diagram of the section "from back to front." Here the key when pressed down rocks upon its balance rail, and is raised at its further end. This carries up a stickler, a slight rod of wood with a pin at each end to keep it in place. The front end of a centred lever, called a backfall, is pushed up, the further end descending. Fixed to the backfall by an adjustable regulating-button on a tapped wire is the tracker, attached to the pull-down, which carries the movement to the pallet, its entry through the floor of the wind-chest being duly protected against escape of wind by a brass plate, pierced with a hole just large enough for it to pass. If the wire wear this hole the "trick of the trade" is to drop into it one drop of castor-oil, which clings round the wire and fills up any possible interstice. (It is perhaps not generally known that castor-oil serves to doctor organs as well as mankind.) The concussion bellows receives any access of wind due to the sudden shutting off of heavy pipes or to unsteady blowing, and delivers it again on demand if heavy pipes should suddenly draw upon the wind and exhaust the wind-chest: thus the wind is kept steady. The front pipes of an organ being arranged not in their proper musical positions, but so as to form an architectural device, it becomes necessary to convey wind to them. They stand upon a separate sound-board, the grooves of which are arranged in an irregular order according to the device, large pipes requiring larger grooves, so as to yield more wind to them than to the smaller pipes. Jointed and mitred metal pipes pass over and under each other as they convey the wind from the proper groove of the great sound-board to the proper groove in the special sound-board. The arrangement is seen in the section from back to front, on Plate II.

As a general rule, the simple action there shown is no sufficient, for the pipes are generally much wider apart than the notes of the keyboard. Either the backfalls are

nade to radiate like a fan, their ends close together in front and widely spread behind, or else motion is given to one arm of a roller-board, and taken off from another point of it, either on the same side of the roller, continuing the motion in a new place, as in the figure in Plate II., or on the other side of the roller, reversing the direction of the motion, as in the section of the roller-board in the same plate. If for the backfall a reversing roller-board be substituted, as in the section, we shall have a more usual form of the most modern mechanical action of organs.

The swell-box of an organ is placed on a separate sound-board, behind the whole of the pipes of the great organ, and long trackers are necessary to convey the motion of the key to the swell sound-board pallets. The usual swell action is incidentally shown in the diagram on Plate II. of the modern "swell to great" coupler. Here the swell key is seen to raise a stickler, and so to rotate a backfall of T shape, the vertical arm of the T coming forward and drawing the long swell tracker with it.

The bellows of an organ is one of the parts needing the most careful adjustment to the requirements of the organ. Everything depends upon a sufficient and equal pressure of wind. Large organs have many bellows, ordinary organs have but one, but the principle is the same in all. The feeders are placed below the reservoir, so that the roof of the latter keeps horizontal whilst it rises or falls. The blower (or the engine which takes his place) sends puffs of air into the reservoir to inflate it by means of the feeders; and it is the function of the reservoir to convert the unsteady blowing into uniform "wind." To do this, heavy metal weights are placed upon the roof of the reservoir, and their pressure forces wind out through the wind-trunks with unvarying force. If it is required to diminish this pressure afterwards, the organ-builder has means to accomplish it; but the wind leaves the reservoir always at definite pressure, which must be the greatest pressure required for the parts of the organ served by that bellows.

The pressure required differs with different organs, and is gauged by an anemometer, the value being stated in "inches." The shape of the instrument is shown in the Plate ORGAN-PIPER. The foot being inserted in the place of a pipe-foot in the sound-board of the organ, water is poured in. This will, of course, stand at equal heights in the two arms of the tube. But on wind being admitted from the reservoir, the pressure of the wind drives down the water in one arm and it ascends in the other; the difference in inches gives the measure. "Three inches of wind" means a difference of that amount between the levels of the water in the two arms of the anemometer. This, or from this to $3\frac{1}{2}$ or 4 inches, is the usual pressure for great organ work; reed stops taking higher pressure, as 6 or 7 inches, and the heavy harmonic stops (tuba, ophicleide, &c.) of the solo-organ, where present, taking higher pressure still, up even to 15 inches. It needs $9\frac{1}{2}$ lbs. weight per foot superficial to give 3 inches of wind. If there is not enough pressure more weight is put on the reservoir; if there is too much pressure the weight there is lightened. In very large organs it is necessary to draw the supply of air for the bellows from somewhere else than the immediate vicinity of the organ, or the constant currents of air resulting will considerably affect the steadiness of tone.

On taking his seat at a large organ the number of appliances he sees at first bewilders a visitor. Three rows of keys are before him; the middle row controls the *great organ*, the upper innermost row the *swell organ*, the lower and nearest row the *choir organ*; sometimes a fourth row, a *solo organ*, is also added at the extreme back, and even a fifth row for an *echo organ*. The swell organ is the only one on which, with any given combination of stops, a crescendo can be produced; varied qualities or quantities of tone on the other manuals are to be obtained by adding

or withdrawing stops. The knobs or draw-stops are arranged on each side of the keys, and are grouped in masses, all those relating to each manual being placed together, and usually bearing some readily distinguishable common mark. Drawing out a stop-knob sets in motion a train of mechanism which results in moving the corresponding slide from right to left, or left to right, as the case may be, so that its series of holes is made to correspond with those in the grooves beneath and the upper board above, and the wind is admitted to the pipes of the stop from all those grooves of which the pallets are open. As certain combinations are found to be most frequently in use, *composition-pedals* or *combination-pedals* are fitted along the front of the organ, conveniently for the feet, and by interior mechanism each of these draws several of the stop-slides at once, pushing out their draw-knobs in the front of the organ-case, and also pulling in any stops previously drawn which do not belong to the required combination, so that the effect to the eye is exactly the same as if the organist had drawn or closed the stops by hand singly. Sometimes instead of this an older method, that of lowering the organ by means of *ventils*, is used. One form of ventils is secondary slides, which lie beneath the usual slides, so that when drawn aside they silence in that manner the stops to which they are applied. This method has always been preferred in France, and was revived not long ago in England, because of its enabling the performer to use any desired combination, instead of being limited to the combinations of the organ-builder. The ventils act exactly the reverse way to the combination-pedals. The first ventil may shut off all but one soft stop. For instance, no matter how many knobs are drawn; the second may shut off all but three stops, and so on. The organist having drawn his desired combination must press down the superior ventil; if he wants to lower the combination he does so with an inferior ventil, blocking out some of his stops, and he returns to his own combination by pressing the superior ventil again. Though very effective this is not generally liked, since the organist cannot so clearly see what combination is available before him, as when the stops drawn are adjusted in the usual way. In addition to combination-pedals, Willis uses for his large organs pneumatic combination-pistons, inserted in the keyslip beneath each manual, and extremely light, so as to be operated by the thumb without taking the hand from the keys. In this way he easily gives, instead of the usual limited combinations, thirty or forty varieties, placing eight or ten buttons on each keyslip.

Beneath the keyboard, at a distance of 32 inches from the great organ keys, lies the pedal-clavier, the swell-pedal and the composition-pedals protruding a little above it at the back. The compass of the pedal-clavier is now two and a half octaves, C to F, and it is so arranged that the second C is exactly vertical with the third C on the manuals, and the front of the pedal "sharps" should be 2 inches further back than a plumbline let fall from the front of the great organ sharps. The scale of the pedals is usually $2\frac{3}{8}$ inches from centre to centre of the naturals (long keys). It has already been said that the pedal-clavier is frequently concave, and sometimes radiated as well.

Among the draw stops, and sometimes also among the combination-pedals, are to be found the couplers, of which the most important are the *swell to great*, which enables the player, by using the great manual, to set in motion the keys of the swell at the same time, the *swell to choir*, and the *choir to great*, which are similar in construction, and the *great to pedals*, *swell to pedals*, and *choir to pedals*, which permit the pedals to operate upon these respective manuals. The action of these couplers is shown in Plate II. The old "tumbler" action consisted of a series of stems inserted in a rotating rod; when the stems were slanting the coupler did not act, but when the rod was rotated until the stems were vertical a connection was made between

the keys. If this coupler was drawn while the hands were on the keys, it either broke the stems or jerked the hands off; and it had many other defects. It is now replaced by a form of coupler where a secondary backfall is moved, say by the great key in *swell to great*, and so made to work the swell tracker, at the same time raising the back of the swell key, and so showing the action to the performer in front, by causing the front of the key to fall. The rail carrying all the coupler backfalls is lifted out of the way when not at work, but the coupler draw-stop depresses it, bringing all the coupler backfalls on to the regulating buttons, and so into action. The *octave coupler* (and its converse, the sub-octave coupler) works on precisely the same principle, but with slanting backfalls, so that any key played operates also the key an octave above itself (or below itself, in the sub-octave variety), and the power of the performer is thereby practically doubled.

With the enormous increase of size in modern organs, and the yielding to the temptations of heavier pressures of wind and consequent greater variety of effects of tone, the effort required to open so many pallets against the force of so many springs and against the far greater force of the wind in the wind-chest, became almost too great for the organist's strength. It is said that the player on the great organ at Haarlem strips to his work like a blacksmith, and is bathed in perspiration at the close of his performance. The most pressing problem was therefore to lighten the cruel weight of the touch, which put an end to all possibility of rapid execution, and made even ordinary passages laborious. On each of the bass notes of the Albert Hall organ is a pressure amounting in all to 20 lbs. weight. For small organs various devices were tried successfully with the pallets themselves. Some are given in Plate III. Baker's double pallet opened a small orifice in the main pallet by means of a small extra pallet; the wind once admitted behind the great pallet the resistance no longer existed and it could easily be opened. The same idea governs the split-pallet of Holt, where the pull-down operates upon a hinged portion at first, and on the remainder of the pallet afterwards. Willis's patent pallet (1861) is hollowed out, so that it only beds by its rims, metal rods pass along the groove-orifice, and the leather roof of the pallet, becoming an air cushion, is pressed against these rods by the wind in the wind-chest, which is admitted into the hollowed interior of the pallet through a hole. The elasticity of this leather air-cushion is great, and is quite sufficient to overcome the wind-pressure on the rim of the pallet. A pressure of 100 on an ordinary pallet would be only 25 upon this form. But even thus, for large organs, more force was imperatively needed. Two agencies have been therefore employed, pneumatic and electric, both of them due originally to one man, Mr. Barker, and though probably electricity will eventually control the great organs of the future, the former is at present perhaps the more usual method. This article may fitly close with an account of the chief developments of both.

Pneumatic Action and Transmission.—It has been mentioned previously that the pneumatic lever was first introduced by an Englishman (Barker), through a French firm (Cavaillé-Coll) in 1841, and first brought to perfection by Willis in 1851 and 1853. Willis's patent pneumatic lever of the former date is shown in Plate III., with its connection on the one side from the keyboard, and on the other to the sound-board pallet. The size of the pneumatic lever is greatly exaggerated for clearness. The older form of pneumatic lever was noisy and dragging, and was replaced by this for universal use so soon as Willis's patent-right had expired. The illustration shows how the action of the organ tends to pull down one end of the pneumatic lever backfall and to raise the other. Pulling down the nearer end, and therefore also the pallet of the pneumatic lever, it admits the wind (with which the organ bellows keeps the wind-chest of the lever fully supplied), and the wind passes

through the pallet to the inlet chamber. The lever, which is a power-bellows, and would be far better thus named, would be lying flat in a collapsed condition previous to the admission of wind, and the choke valve would be open. The wind rushing in inflates the lever; its roof rises and draws with it the choke valve, *c. v.*, cutting off the supply of wind as soon as it is fully inflated. But as it rises, the lever pulls with it the tracker of the sound-board backfall, rocks the backfall, and so causes its further end to pull down the sound-board pallet, and the pipe at once speaks. When the key is released the pallet-spring in the pneumatic lever closes its pallet and so rocks the pneumatic lever backfall, opening therefore the outlet valve, and allowing the compressed air in the pneumatic lever to escape; the lever collapses, pushing down the sound-board backfall, and thus rocking it, releases at its further end the sound-board pallet of the organ, which is at once closed by its own spring, and the pipe now ceases speaking. The double pallet of the outlet valve in the pneumatic lever is very ingenious. It will be seen to be kept close by a spring pulling *up* the left hand part, and thereby, since the valve is centred, pulling *down* the right hand part. Not only is the orifice for escape thus doubled in size, but as the wind pressure is equal and opposite upon the two parts of the valve this important factor is neutralized and the valve is without weight, except for its own spring, a really vital consideration. The increase of power given by a pneumatic lever is incredible till one has tried it. It is comparable to the increase gained by judicious construction of hydraulic machinery, as explained in the article *HYDRAULICS*. A very slight puff of wind is sufficient to exert great force. The only weight upon the key is the spring of the pallet of the pneumatic lever; the lever does all the rest of the work. It is of course necessary to arrange the pneumatic levers in tiers as close as possible to the key action. Originally the mistake was made of putting them near the pallets, so that the key had a great weight of mechanism to move. However, even after this excellent improvement (still in general use), a certain noise and a far more important deficiency, namely, a slight loss of time taken up by the action of the pneumatic lever, remained; so that the organist was annoyed by a little rattling and by the keys always playing a little in advance of the sound. In 1884, therefore, Mr. Vincent Willis invented a most remarkable piece of mechanism, which is engraved in Plate III., and which may be pronounced the perfection of the pneumatic lever. (The term was used by the jury in the Inventions Exhibition in 1885, where the lever was first exhibited, and gained the gold medal.) Here a floating lever is introduced, suspended by a centred piece, *d*, and resting between two buttons. The key-backfall depresses the end *c* of this lever. The lever is thus made to press on the lower button, the end *d* serving as a temporary fulcrum; the inlet valve, *a*, is opened, and the wind rushes up into the pneumatic lever and inflates it. As the pneumatic lever rises it draws with it the tracker of the sound-board backfall, as in the ordinary form, rocks the backfall, and so sets the pipe speaking; but it also draws with it, at the same time, the rod hinged to the floating lever at *d*, and the point *d* rises. The floating lever now, by thus rising upon *c* as a fulcrum, permits the inlet valve, *a*, to close; therefore both the inlet and outlet valves are at this moment closed, but the pneumatic lever remains inflated, and continues to do its work by keeping open the sound-board pallet, and the pipe therefore continues to speak. When the organist withdraws his finger from the key the pipe ceases to speak instantaneously, or practically so, for the point *c* rises, *d* serving now as a temporary fulcrum, and the floating lever presses on the upper button and opens the double exhaust valve, *b*; the compressed air or "wind" passes at once out of the pneumatic lever by two channels into the atmosphere, and the pneumatic lever collapses. But this means, besides the closing of the

sound-board pallet and the ceasing of the sound, the falling of the point *d* also, and the consequent release of the pressure upon the upper button. The double outlet valve, *b*, therefore closes, and again both outlet and inlet valves are closed. The rapidity of action of this lever is inconceivable, far exceeding the dexterity of the finger; it can easily be made by mechanical means to give thirty repetitions of the note in a second. The springs which keep the valves *a* and *b* closed are not shown in the figure.

Pneumatic tubular transmission was shown in the part of this article dealing with the swell to have been a device of Willis ever since 1861, and to have been found capable, as in the well-known St. Paul's organ, of conveying motion to great distances. In Plate III. the patent of 1868 is shown as applied in St. Paul's (and of course in many other organs also), to draw the slides of the stops in the distant organ. On the right hand of the Plate is seen the draw-stop, operating a three-way cock. When the stop is drawn the "wind" is allowed to exert its pressure; this will instantaneously blow upwards the flexible diaphragm of the disc-formed pneumatic lever (*z*) at the far end of the tube, the stop slide will be thrust in, and the stop speaks; when the draw-stop is pushed home the exhaust (suction) is laid open by the three-way cock, and the air is drawn out from the tube till the pneumatic valve *z* at the other extremity falls, the slide is drawn back, and the stop ceases to speak. The smaller form of disc-lever (*y*) is that which is applied to the mechanism of the sound-board pallets, where there is but little chance of noise, and is controlled by the key under the organist's finger, acting directly upon the supply and exhaust valve at the keyboard end. But the force of the large pneumatic disc-levers is great, and they become in the simple form (*y*) seriously noisy. The arrangement (*z*) in the Plate is therefore necessary for large disc levers. A central button is placed in the midst of a flexible leather diaphragm. To this button is attached a shank passing through a cylinder, at each end of which is a disc, the discs being pierced with holes, as shown in the perspective representation at *x*. Matters are so arranged that this throttle-valve, for such it is, shall close upwards slightly before the diaphragm is at its greatest pressure, and shall close downwards slightly before it reaches its greatest suction; therefore in each case, when the great part of the work has been swiftly and vigorously done, the pressure or exhaust, whichever it may be, will cause the rest of the action required, not acting vigorously through the full aperture of the lever, but in a very limited way through the small hole in the disc of the throttle-valve, thus reducing the stroke at its cessation at either end to a weak and noiseless movement. It is perhaps hardly necessary to add that pneumatic tubular transmission, when used to an important extent, requires a considerable bellows-power. The bellows at St. Paul's Cathedral are of huge dimensions, and those at the Albert Hall are worked by a steam-engine.

Electric Organ.—The original idea of using electricity for organs has been stated to be due to Dr. Gauntlett, who, in 1851, proposed to play electrically several organs at once in the first International Exhibition, but was snubbed by the council for his pains. He patented an electric method in 1852, but it was not practical, and nothing came of it. It was Mr. Barker, as before said, who, in 1867, really discovered a practical electric action. Close to the back of the keys a rail runs from bass to treble, the full width of the keyboard; and in this rail two rows of cups are bored in pairs; a pair of cups, one back and one front, belonging to each key. The cups number 112, therefore, to a manual of 56 notes. They are lined with shellac varnish and filled nearly to the brim with mercury, in the manner shown in Plate III. ("Barker's Method, Making and Breaking Circuit"). A long brass plate passing from end to end of the mercury-rail, on the side nearest the

keys, is connected to the whole front row of mercury-cups by screws, one screw penetrating into each cup. This long brass plate serves as the general "positive" conductor of the organ, or rather of that one department of the organ; for it is evident that this construction must be repeated for each keyboard or "manual." The positive wire passes from the positive pole of the battery to this brass plate, and is technically known as the "positive main current wire." On the other hand, each mercury-cup of the back row has its own particular wire, kept in electrical connection with it by a screw penetrating to the mercury in the cup, like the screws of the other row. There are thus fifty-six separate wires to the back row of mercury-cups of each manual, and each of these wires goes to the electro-magnet of its own particular sound-board pallet. There are, of course, fifty-six horse-shoe electro-magnets, one to each pallet; and while each magnet is connected by one end of the wire of its *helix* (coil) to the back mercury-cup of its own note, as just described, it is connected by the other end to a long brass plate passing along the whole width of the row of pallets and connecting the currents of all the electro-magnets, serving therefore as the general "negative" conductor of the organ, just as the brass plate on the positive main current was shown to serve as the general "positive" conductor. The construction is exactly similar in reversed order. In like manner there is one "negative main current wire," which passes from the general negative conductor to the negative pole of the battery.

From this it is evident that a circuit will be completed if only the front and back mercury-cups in the rail at the back of the keys are brought into electrical connection. In the Plate the means whereby Barker accomplishes this connection are shown. Attached to the key-backfall are two pointed copper wires fastened together by a copper plate—they are therefore electrically one. A copper staple driven through the backfall would present a like construction. When the key is at rest these two wires have their points half an inch or more above the mercury; but when the key rocks the backfall both wires are plunged into the mercury, one into the front or positive cup, the other into the back or negative cup, and the circuit is thus at once made. The course of the current is as follows:—From the positive pole of the battery the current passes by way of the general positive conductor (brass plate) to all the positive mercury-cups, including that of the given note, then up the positive backfall wire of one note only. (We are supposing one note to be played by itself, and therefore its wires to be the only ones dipping into the mercury-cups.) The current passes over to the negative backfall wire, and so down into the negative mercury-cup; thence through the screw penetrating into the mercury of that cup it passes to the negative wire, and so away to the electro-magnet of that particular note. Having coursed through the magnet it passes to the brass plate, serving as the general negative conductor, and so by way of the negative main-current wire to the negative pole of the battery, as has been described.

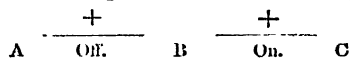
The magnets next demand attention. In the articles **MAGNETISM** and **ELECTRIC LIGHTING** the remarkable property has been explained whereby a bar of soft iron bent into the form of a horse-shoe becomes a powerful magnet if an electric current is made to pass round each of its arms through a *helix* or coil of insulated wire. The instant the current ceases the iron is no longer magnetic. Barker placed such an electro-magnet beneath each pallet of the sound-board, with an iron armature beneath, working from a centre. The circuit being made, and the magnetic action set up, the armature is attracted, and its free end flies up towards the poles of the magnet. In Barker's patent (1868) the motion of the armature thus gained was made to operate a pneumatic lever, and through its agency to draw down the sound-board pallet in the

usual way. Messrs. Bryceson, when they purchased the sole concession from Barker in that same year (1868), were alive to the disadvantage of these intermediary pneumatic levers; and they invented and patented their excellent pneumatic pallet, which is engraved in Plate III. Here the pallet, *b*, is seen to be a pneumatic lever in itself; its upper surface, clothed with soft leather, when inflated closes the groove of the sound-board, as all pallets are meant to do. The armature of the electro-magnet, *a*, beneath the pallet is at no more than the thickness of a shilling away from the poles of the magnet. The electric circuit being made by the key as described, the current passes, and the soft iron horse-shoe becomes a magnet; the free end of the armature flies up, and rocks a little lever within the pallet, closing the valve leading to the wind-chest, and opening the valve which communicates with the exhaust-chamber. An exhaust or suction-bellows draws away the air from the exhaust-chamber, and so sucks down the upper surface of the pneumatic pallet from its seat against the sound-board bars. Besides the pressure thus being taken from within the pallet, the compressed air which surrounds it on the outside (in the wind-chest) aids in collapsing it by pressing its sides or ribs inwards, and thus accelerates its action. The pallet collapsed, the wind passes through to the groove, and the pipe begins to speak. When the circuit is broken by the rising of the key, the armature falls from the horse-shoe, now no longer a magnet, the wire drops, and the end *c* of the little lever within the pallet is no longer held up by it. The exhaust, therefore, sucks *c* close and opens *d*, leading into the wind-chest. The compressed air rushes into the pallet and inflates it, pressing its upper surface once more tight against the sound-board, and the pipe ceases speaking. The spring shown within the pallet is only necessary to keep it closed till the wind is in, that is, till the wind-chest is full of compressed air, after which the pressure of the wind in the pallet is always sufficient to keep it to its work. The pallet may be truly said to be blown-to and sucked-open. The advantage of using exhaust (suction) instead of pressure, wherever it is convenient to do so, is manifest; because the sides of the bellows can never blow out, reversing their shape, as under pressure they sometimes do; nor can they ever be strained to bursting; and moreover the pressure of the air or of the wind without, assists materially to close an exhaust bellows, pneumatic lever, &c., by pressing on its ribs or sides in the manner already described.

Similar work operates the stop-slides—always through some pneumatic intermediary. Thus in Plate III. is shown Bryceson's electrical draw-stop action, working by pressure and exhaust. Two powerful pneumatic levers are seen to be so connected that when one is expanded the other is collapsed; they are separated by a central chamber continually exhausted by a suction-bellows. The metal double-action disc-valves, rising all together on their rod at the bidding of the puff-bellows, *p*, and falling by gravity, so open and close the ports leading to the exhaust and to the outer air that the pneumatic levers are alternately exhausted. Thus a to-and-fro or reciprocal motion is given to the bar connecting the two pneumatic levers, and to this bar the stop-slide is attached and is drawn in or out. Two electro-magnets are required, one to draw the stop on, and the other to shut it off, or what is the same thing, one to cause the exhaustion of the right-hand lever, and the other that of the left-hand lever. In the figure this is seen to be accomplished by a double-armature. The stop has just been shut off. The left-hand magnet only has been brought into action, and the armature has flown up to it, and thereby closed the valve of the magnet-chamber (which represents merely an escape-valve to the outer air), and has opened at the same time the valve above it, admitting the wind from the main pressure-bellows of the organ. The wind has inflated the puff-bellows, *p*, and pushed

up its rod and all the disc-valves on it; thereby opening a communication between the left-hand bellows and the exhaust, atmospheric air passing in to fill the expanded right-hand bellows. The slide is therefore thrust to the right, and is off. If now the organist draws the stop on, the right-hand magnet only is brought into play, and the right end of the armature flies up to it; the pressure is cut off, and the escape-valve into the magnet chamber is opened; the puff-valve sinks, pressed down by the weight of the falling metal disc-valves on its rod. The result is manifestly that the right-hand bellows will be open to the exhaust chamber, and the left-hand bellows to the outer air; the stop-slide is therefore drawn back to the left hand, and is on.

But it may be reasonably objected that it would be a great waste if these magnets were always, either the one or the other, in circuit, whilst the stop-slide is only moved in or out at very long intervals. There is no such waste of power; in fact, the danger lies the other way, for the electrical connection is scarcely more than momentary, and very ingenious precautions have in consequence to be taken, in order to prolong its action. The annexed diagram will make clear the action of the draw-stop; that is, of the rod which carries the stop-knob at its outer extremity.



Two contact surfaces, one carrying the positive and the other the negative wire, are required for each of the two electro magnets shown in the Plate; one pair of contacts for the "off" and the other for the "on." The draw-stop is furnished with a metal forked spring sufficiently wide to touch both positive and negative surfaces of either one or the other pair, and therefore to complete the circuit of either the "on" or the "off" magnet, producing a corresponding motion of the stop slide to the left or the right, as already described. Now let the end of the draw-stop, carrying its spring contact surface, be at the neutral point *n*. The organist draws out the stop-knob and the end of the draw-stop comes forward to *c*, its extreme position when drawn out. In so doing it has momentarily connected the $\begin{array}{c} + \\ \hline \end{array}$ and the $\begin{array}{c} - \\ \hline \end{array}$ of the "on" pair of contact surfaces as its spring passed over them; and during that movement the "on" magnet has acted. To give time for the exhaustion and inflation of the pneumatic levers which move the stop-slide, ingenious delay devices have to be used. Without these precautions it might be possible to make and break contact so swiftly that the pneumatic levers would not have time to act. Passing now to the opposite motion, when the organist thrusts in the stop-knob the end of the draw-stop with its spring contact surface passes from *c* over the "on" pair, connects them, does not disturb existing arrangements thereby (since the stop is already "on"), passes to the neutral point *n*, and then over the "off" pair of contact surfaces to *a*, which is its position when pushed home. But in passing from *n* to *a* it has thrown the "off" surfaces into momentary connection, and so brought the "off" magnet into circuit; and the swift electric current (suitably delayed by the devices already referred to) now reverses the position of the armature, and realizes the condition "off" shown in the engraving on Plate III.

It is observable that a Bryceson electric organ requires, in addition to a pressure (ordinary) bellows necessary to provide the wind for the pipes, &c., an exhaust bellows to operate the pneumatic pallets, &c. The two pneumatic forces of pressure and exhaust are made serviceable in many ways. It may be added that an exhaust of 6 inches (measured by the anemometer as usual) is provided for draw-stop action, &c., but it is reduced to about three-fourths of an inch only, for the delicate work of the pneumatic

pallets. The pressure wind is of course the same as for other organs.

The action of the electric organ is instantaneous. It has also scarcely either weight or motion; for all the key has to do is to plunge the backfall wires into the mercury, and all the electro-magnet of the pallet has to do is to raise its armature the thickness of a shilling and to overcome the feeble spring within the pallet. In striking contrast to the heavy and deep touches necessary for the key-boards of many mechanical organs, the keys of the electric organ have therefore to be accommodated with that degree of artificial weight and depth of stroke which meets the pleasure of the performer; otherwise they would be uncomfortably light and shallow.

The precautions observable are very few. The mercury must be absolutely pure; it then remains permanent for many years. The wires plunging into it must be kept free from oxidation, and to facilitate attention to them the keyboards are hinged in front so that they turn over like the action of an ordinary harmonium, and the whole of the wires and mercury-cups are exposed. Two batteries are required, one being at rest while the other is serving: a draw-stop instantly brings on the fresh battery directly the organist perceives that the other one begins to fail in power. To avoid waste the electrodes are lifted out of the battery, and chemical action at once ceases, when the organist leaves off playing; this is effected automatically by the reservoir of the bellows, which performs the necessary work, as it sinks down when the wind "goes out" because of the blower leaving off work. As a specimen of the amount of power required, Bryceson's electric organ in the Inventions Exhibition of 1885 (which was awarded a gold medal) was worked by a battery of four bichromate cells, with another one of equal size kept in reserve. The battery served for about twenty hours of playing, and its cost was about a penny for each hour the organ was used.

An electric organ is manifestly quite independent of distance or position. The electric organ at the Lyceum Theatre (1886), for instance, though at the extreme back of the stage, is played from the orchestra. Very few church organs are so built that the organist can hear clearly what he is doing, or can control his choir. With an electric organ, however, he sits in the midst of his choir at what is apparently a small harmonium, and the electric wires pass thence along a tube, to the other end or side of the church, or overhead, or round corners, &c., to wherever the necessities of architecture or acoustics may have caused the organ to be placed.

Although Messrs. Bryceson (retaining their own patents) generously allowed Barker to offer the principle of the electric action to any other builders, no one took it up seriously except themselves, till the Exhibition of 1885, when Willis and Walker both adopted it for one department (the "solo") of their organs. A sliding contact of Messrs. Willis, then first exhibited, is shown in the Plate. A spring acts as a contact piece connecting the positive mercury-cup with the negative through a metallic sliding piece when the key is played (the back of the key rising), but disconnecting them when the key is not played, and when therefore the back of the key falls, because then the end of the spring rests against an insulating surface (glass, ebonite, &c.) inserted in the sliding piece. The construction of this sliding piece obviously permits the contact to be as rapidly made and broken as is desired, and the key can "repeat" at the thickness of a card if desired. In this construction the points are never entirely withdrawn from the mercury.

The largest organ in the world is that at the Albert Hall, London, with 111 sounding stops and 7806 pipes. The next largest is that at the Cathedral of the Incarnation, New York, with 115 sounding stops, but only 7252 pipes; the action being partly electric, partly tubular pneumatic.

Albert Hall Organ.—As a specimen of the largest and most famous modern organs, it may be interesting to add some of the chief details of the great organ at the Albert Hall, South Kensington (Willis, 1870).

There are four manuals (choir, great, swell, solo), with a compass of five octaves each, from C to c'''; and the pedals, concave and radiating, have a compass of thirty-two notes, two and a fifth octaves, from CC to g.

The *Choir* organ, all of metal pipes, has twenty stops: one of 16 feet pitch, violone; five 8 feet, gamba, dulciana, lieblich gedact, open diapason, and vox angelica; four 4 feet, principal (harmonic), gemshorn, lieblich flute, celestiana; three 2 feet, flageolet, piccolo, super-octave; a mixture of three ranks:—and six reed-stops, namely, corno di bassetto (16 feet), clarinet, cor anglais and oboe (8 feet), clarion (4 feet), and trompette harmonique (16 feet and 8). 1330 pipes.

The *Great* organ contains twenty-five stops, all of metal, except the basses of the bourdon and claribel, which are of wood: four 16 feet, flute conique, contra gamba, violone, bourdon; six 8 feet, two open diapasons, gamba, claribel, flute harmonique, flute à pavillons; one 6 feet, quint; three 4 feet, flute harmonique (octave), viola (octave); one 3 feet, quint (octave); two 2 feet, piccolo harmonique (super-octave); a furniture and a mixture of five ranks each:—and six reed-stops, namely, contra-possaune (16 feet), possaune, tromba (8 feet), trompette harmonique (16 feet and 8), clarion harmonique (8 feet and 4), and clarion (4 feet). 2013 pipes.

The *Swell* organ contains twenty-five stops, all of metal, except the basses of the bourdon and claribel: two 16 feet, double diapason and bourdon; five 8 feet, salcional, open diapason, gamba, flute à cheminées, claribel; one 6 feet, three 4 feet, one 3 feet, and two 2 feet, the same as in the great organ; a sesquialtera and a mixture of five ranks each:—and nine reed-stops, namely, contra-possaune, contra-oboe, baryton (16 feet), voix humaine, oboe, corneopean, tuba major (8 feet), tuba clarion (4 feet). 2013 pipes.

The *Solo* organ contains twenty stops: one 16 feet, contra-basso; five 8 feet, flute à pavillons, viola d'amore, flute harmonique, claribel, voix céleste; two 4 feet, flute traversière, concert flute; one 2 feet, piccolo harmonique; one cymbal-mixture of seven ranks:—and ten reed-stops, namely, corno di bassetto (16 feet), clarinet, bassoon, French horn, ophicleide, trombone, oboe (8 feet), bombardon (16 feet), tuba mirabilis (8 feet), and tuba clarion (4 feet); the first four reed-stops and the oboe are inclosed in a swell-box. 1586 pipes.

The *Pedal* organ contains twenty-one stops, no less than four of which are of 32 feet: double open diapason, the enormous pipes of which look so imposing in the front of this organ, double open (wood) and contra-violone, as well as the great reed; four 16 feet, open diapason, and another open of wood, bourdon (wood), violone; one of 12 feet, great quint; two of 8 feet, violoncello, octave (wood); one of 6 feet, quin; one of 4 feet, super-octave; a furniture of five ranks and a mixture of three ranks:—and seven reed-stops, namely, the mighty 32-feet contra-possaune (wood), contra-fagotto (wood), ophicleide (wood), bombarde, trombone (16 feet), fagotto (wood), clarion (8 feet). The pedal stops are of metal, except where stated to be of wood. 864 pipes.

There are fourteen couplers (draw-stops); a sub-octave and a super-octave to both the solo and the swell; solo, swell, and choir each separately to great; solo and swell each to choir; each of the four manuals separately to pedals; and sforzando.

There are thirty-two combination pistons, eight to each manual, disposed on the keyslip beneath each manual, and workable without taking the hand from the keys.

There are twenty combination pedals; one double-acting vertical movement to throw on the whole pedal organ and couple the great organ to it, and to throw off the great

and all the pedal except the bourdon, violone, open diapason, and octave; six ventils on the pedal stops; two pedals to connect and disconnect these ventils with the great organ, six others for various effects of combination, so that by one movement the whole organ can be altered in every part; two tremulants (solo and swell); a sforzando; and two pedals (on and off) coupling great to pedals. The swell can be also operated by the mouth of the performer, as described previously in this article.

The metal for the internal pipes is 5 parts pure tin to 4 parts lead; but that of the splendid front burnished pipes is 9 parts pure tin to 1 part lead, which is as nearly pure tin as is possible, allowing for necessary soldering power.

The organ stands 70 feet high, 66 feet wide, 40 feet deep, weighs over 150 tons, and contains altogether 7806 pipes. Of its 111 sounding stops (all running the full length, save only the vox angelica on the solo organ, which has forty-nine pipes), seventy-three are flue stops, and thirty-eight are reeds.

The exterior of the organ affords scope for fine architectural work. Many of the older organ cases, such as that of Grinling Gibbons at St. Paul's, are very fine designs; but it must be admitted that the modern tendency is to group the pipes in a few simple inexpensive devices. The costly immense fabric of the famous organ case at Bergen-op-Zoom goes too far in the opposite direction, of course. Architects are now becoming aware of the opportunities of fine form and colour afforded them, and do not, as hitherto, leave the whole matter in the hands of the organ-builder. A thorough and comprehensive work on this interesting subject, by A. G. Hill, appeared in 1883, under the title of "The Organ Cases and Organs of the Middle Ages and the Renaissance."

ORGAN, BARREL. See BARREL-ORGAN.

ORGAN-POINT. See PEDAL-POINT.

ORGAN-PIPES. It was shown in the article ORGAN that an organ-pipe of the "flue" kind (diapasons, flutes, &c.) is nothing more than a large whistle-pipe. The motion of the air in sounding pipes of all kinds (as is said in the article ACOUSTICS) is generally referred to the ordinary organ-pipe as a standard. The considerations governing reed-pipes, however, whether those of the organ or of orchestral instruments, are treated of in the article on REED INSTRUMENTS in this work, and the reed-pipes of the organ (one of which is engraved in the Plate accompanying this article) are consequently there, and not here, described.

Organ-pipes (*i.e.* flue-pipes) are of metal (round) or of wood (square). Both kinds are figured in our Plate. The material of which the pipe is made is believed to make no difference as such, either in the pitch or quality of the sound, but the thickness of the pipe makes a great difference; therefore as pipes can be made thinner with harder metal, material, by controlling thickness, does after all make differences in a secondary way. Pipes made of glass and of brown paper have been tried, and successfully, to prove these points; and indeed every flute player knows that except for the thickness of the blowing edge at the embouchure there is no difference between a metal flute and a wooden one, nor between a silver flute and one of baser metal. Lord Brougham had a stop in his organ made entirely of silver: the only perceptible results were the constant attempts to steal the pipes, attempts sometimes only too successful. The thickness and the disposition of the mouth, &c., control the quality of tone, together with the width of the pipe relative to its length, and the pressure of the wind blown into it. The pressure is measured by the *anemometer* [see Plate], as described in the article ORGAN. The pitch of the pipe depends solely on the length, but wider pipes require slightly shorter lengths for the same note than do narrower ones.

Taking first a metal pipe, we find it circular in section,

It is supported in a vertical position by a rack, and its *nose* enters the hole in the sound-board table, through which the wind is supplied to the pipe. After the nose follows a conical *foot*, rapidly diverging to the full diameter of the *body*. Across the top of the foot is fastened a flat plate of metal called the *languid*, blocking up the foot all except a narrow open strip in the front. The languid is notched on its front edge. The front both of the foot and of the body of the pipe is beaten in to a flat surface (the *leaf*), and a rectangular opening is cut in the upper leaf (that of the body); this opening is called the *month*. The wind therefore passes between the languid and the lower lip, crosses the orifice of the month, and is split against the sharp edge of the upper lip as it passes up the body of the pipe.

The wooden pipe is rectangular in section. Here [see Plate] the wind enters by a wooden pipe called the *foot*, passes into a chamber in the *block* so arranged as to direct the current towards the month, where the wind splits against the sharp bevelled edge of the upper lip as it passes up the body.

Both metal and wooden pipes have bodies sometimes of unvarying diameter, sometimes conical (or pyramidal), outwards, and sometimes inwards. Some forms of reed-pipes are shown in the Plate (the principle is the same for both flue and reed-pipes), and of these A gives the purest and most brilliant tone, and most resembles the reed instruments of the orchestra form; B, with a reversed cone as a top, gives a muffled tone; and C, which has a divergent cone surmounted by a reversed cone, so as to form a chamber at the top of the pipe, gives a remarkably full and resonant tone. This effect is due to the resonance of air in closed or partly-closed cavities, too intricate a subject for discussion in this place.


It is easy to excite vibrations in the column of air filling the body of a pipe of the character described. Let a tuning fork be prepared with a wafer, &c., fixed to one prong, of a size such as almost to equal the opening of the pipe (a stout glass tube or a joint of a flute will do, the holes of the latter being all closed), and then let the tuning fork be set in motion by a blow on the unloaded prong, the fork being held as in the illustration in the Plate, and a note of surprising clearness will be produced by the repeated regular impulses given by the fork to the air in the tube. If the experiment fails it is because the fork and the tube are out of unison, and either the fork must be loaded or the pipe shortened (e.g. by a movable stopper). A flute may also be set sounding by a tuning-fork held in front of the ordinary embouchure.

The mode of excitation of sound in the usual organ-pipes may be understood by the next figure on the Plate, where the month of an experimenter is seen blowing across the opening of a pipe, as boys do across a bottle neck or the pipe of a key, the stream being directed against the further edge. As it strikes that edge a small part will be deflected down the tube, and will pass onward as a wave of condensation; then, reflected from the further end of the tube, it returns, and as it reaches the end whence it set out it expands beyond the tube, and the surplus is lost in the atmosphere. But in making this expansion it has lifted up the stream of wind so that the breath no longer strikes the edge of the pipe. The moment the expanding pulse has passed into the air, the current falls down and resumes its place, and a new wave of condensation is formed by it and sent down the pipe. Thus the current passing over the aperture is kept in a constant state of flutter, alternately grazing and passing free of the edge of the pipe at regular intervals controlled by the velocity of sound and the length of the pipe, that is, by the length of time a sonorous pulse can run down the pipe and back again.

If two pulses of condensation or of rarefaction travel in opposite directions in the pipe, a *node* is formed at the
vol. x.

point where they meet one another; such nodes are figured as in the Plate, and when once formed remain invariable, the air in the pipe being stationary at these points, though undergoing varying pressure as the opposing pulses pass through their various phases from the extreme of condensation to the extreme of rarefaction. The air between the nodes vibrates as a *ventral segment*, figured as in the Plate, the molecules swinging first one way and then the other. Now when an organ-pipe is blown, before it is made to speak, the wind passes up just outside the upper lip. By so doing it creates a "vacuum" (as in a chimney pot, or in the well-known toy called a spray-producer); the air within the pipe therefore is drawn forwards, and a pulse of rarefaction formed in it which passes up the pipe, while at the same moment it is contradicted at the mouth of the pipe by the outer air which rushes in. The thin stream of wind from the organ bellows, which may be called an air-reed, is thrown by this inrush against, and slightly within, the mouth of the pipe, and produces a pulse of condensation there, which in its turn passes upwards along the pipe, transferred from molecule to molecule, as a wave over a field of corn passes from ear to ear. The elasticity of the air soon drives out the air-reed again, and it blows once more as at first, across the month, just outside, producing a "vacuum" and a pulse of rarefaction. Thus the air in the pipe at the level of the mouth is alternately rarefied and condensed by the vibration of the air-reed, and the pipe speaks. Now, follow the first pulse of rarefaction as it proceeds up the tube. On reaching the open end the pressure of the outer atmosphere quickly converts it into a pulse of condensation, and so it passes backwards down the pipe till it reaches nearly half-way to the mouth. But the first pulse of condensation passing up from the mouth here encounters this first pulse of rarefaction, now returning as a pulse of condensation from the open end, and a node is formed. The two pulses swing together at the node, mutually compress each other with exactly counterbalancing pressures, and then swing apart as pulses of rarefaction; then as the one reaches the mouth and the other the open end, each is converted to a pulse of condensation, and as such returns to the node. The pressure at the node is such that if a hole be bored there and a lighted taper held near it, it will be blown out at the first swinging together of the pulses of condensation. The deepest note an open pipe can sound is that which is thus formed by vibration with one node. The node is rather nearer the open end than the mouth, because of the wind from the bellows, which is stronger than the atmosphere without the pipe; but it is practically in the middle. Stronger blowing produces two nodes, which occur at about one-fourth and three-fourths of the length of the pipe from the mouth, and the note heard is an octave above that sounded by the one-node vibration. The next division is into three nodes, giving the Twelfth to the prime tone, and so on in the order of harmonics given in the article ACOUSTICS. Now, reverting to the first starting of the vibration in the column of air contained by the pipe, it is remembered that this occurred as a pulse of rarefaction caused by the outward swing of the air-reed at the month. The inward swing occurred when the pulse of rarefaction had just reached the top of the pipe, and, converted into a pulse of condensation, had begun to descend, so that the two pulses of condensation met in the middle of the pipe. While the air-reed swings inwards, then, a pulse of sound travels the length of the pipe; and a whole vibration (once in and once out) takes the time for a pulse to pass up and down the pipe. But sound travels with a velocity which is uniform so long as the temperature is unaltered, being always 1090 feet per second at freezing point, and 1115 at moderate or temperate warmth. We have only therefore to measure our pipe in feet, double it, and divide 1115 by it, to find the number of vibrations per

second given by a wave of that length, and this number measures pitch. [See ACOUSTICS.] The standard pitch for the organ is the 8-foot open pipe, which is the pipe of the extreme bass key of the "open diapason." This gives a sound-wave of 16 feet in length, and therefore the

note C  which is the same as the lowest note

on the violoncello. An open pipe 4 feet long gives a sound-wave of 8 feet, and the note c, the octave above the C in the illustration; and one 16 feet long gives C C, the octave below it, which requires a sound wave 32 feet long. The longer the pipe the deeper the tone.

But there is another large class of organ-pipes. Suppose the top of the pipe is not open, but filled with a stopper, what happens? Then the first pulse of rarefaction which is sent up the pipe returns as a pulse of rarefaction unaltered, simply reflected by the stopped end of the pipe; the air-reed has by this time swung inwards, and converts it to a pulse of condensation, which also passes up and returns reflected, to be converted by the outward swing of the air reed to a pulse of rarefaction. But from rarefaction to rarefaction, or from outward swing to outward swing—that is, one complete vibration—it is clear the sound-pulse has travelled four times the length of the pipe, counting from the mouth to the under surface of the stopper; namely, twice as a pulse of rarefaction and twice as one of condensation. A stopped pipe of 4 feet long therefore gives a sound-wave of 16 feet, the same as an open pipe of 8 feet. At the same time the tone is much altered in quality, owing to all the even partials of its series (the second, fourth, &c.) being suppressed. It becomes dull and indefinite as compared with that of an open pipe.

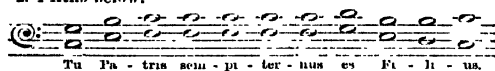
Organ stops are always described in terms of the length of the longest pipe which would be required if open pipes were used. Thus, if the stopped pipe of 4 feet long, spoken of above, is the lowest note (C) of a stop, that stop is said to have an 8-foot tone; and when a 16-foot bourdon is spoken of, the longest pipe in the stop (CC) is only 8 feet in length, because this stop belongs to the stopped variety.

ORGANUM or DIAPHONY was the first rude systematic attempt at harmony among the Western nations, so far as we at present know. It is very curious that in Greek music diaphony (*diaphonia*) meant "dissonance," for it was the exact opposite of symphony (*sumphonia*) or "consonance." But during the dark ages the meaning of the word got altered, and we read of "delectable diaphony," *dulcis concertus* (sweet concord), &c. The other and more usual term, *organum*, presents no such difficulty, for it manifestly comes from the power of the player on the organ (*organon* in Greek, *organum* in Latin) to add a second part with the right hand, while the melody was played or rather hummed out with the left, or *vice versa*. To "organize" was therefore to add an *organum*, or as it was later called a *disant*, or later still a *counterpoint* (which is the term we still employ), to a given melody, above it or below it. But while counterpoint is full of rules compelling variety on the side of the added part, and while even disant encourages freedom of motion, the primordial organum slavishly follows its original at a fixed distance. There are four chief varieties—(1) at a Fourth above or below the subject; (2) at a Fifth; (3) at either of these doubled; (4) at both of them combined. Huebald, the monk of St. Amund in Flanders (840-930), from whose very clear account we know most about this ancient harmony, gives specimens of every kind. Thus we have—

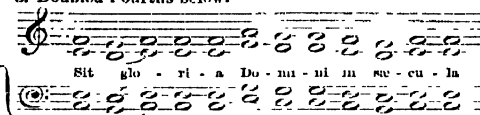
1. Fourths below Plain-song.

Pa - tris seu - pi - ter -

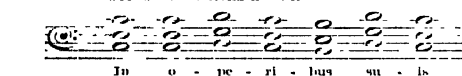
2. Fifths below.



3. Doubled Fourths below.



4. Fourths below and Fifths above.



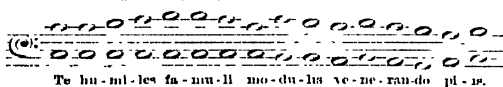
It is noticeable even here that in the second example a little freedom is taken at the close, showing that the chain of organum already galled. We know of organum first only a little before Huebald's own treatise—namely, from an allusion to it in Scotus Erigena; but both Huebald and Erigena speak of it as a well-tombed style, already probably of long growth. Indeed we know that at first the organum did not run throughout, but consisted merely of a Third added on the note before the last to form a cadence. From this the organum extended to a continuous part, and was also changed from the harsh tuncles Thirds (Pythagorean system) to the perfect Fourths and Fifths.

Organum sounds frightful to us, for consecutive Octaves and Fifths (and Fourths also, between outside parts) have long been distasteful to cultivated ears; and many attempts have been made to explain it away, such as that the organum was not sung with, but after, the subject, &c. But any one who refers to Huebald's plain voices must at once reject all such supposition. The monk says that the organum was sung with the plain-song, and that of course is finite. But the matter is not so bad after all. If we remember that the whole of the clergy, and in early times the laity too, were singing the plain-song vigorously, whilst but one or two voices were "organizing," we shall see that an approach is made to a mixture stop of the organ, or to an artificial construction of a compound tone [see ACOUSTICS]; and as with those cases so would it be with the organum, it would melt into and enrich the prime tone, losing its own individuality.

But already in the early times of Huebald the rigid continuous organum was felt in some, and the monk gives examples of licenses allowed in his day. For instance, one variety was for the organum to hold on one note nearly all through, like a drone, while the plain-song was sung above.

Gerbert, the antiquary, gives a later development of this, well on the way to disant, as follows:—

5. Plain-song above, Organ below.



This example contains Thirds, Sixths, and octaves; but Huebald, of course, does not know of anything so advanced. Already by the time of Guido d'Arezzo (983-1050), the organum No. 4 had begun to sound strangely harsh, and Guido expressly mentions his dislike of it. Thus grew up disant, and the milder organum in Sixths instead of Fifths, called *faux bourdon*; and finally, out of them quickly developed the majestic counterpoint.

OR'GEAT (Fr.), a liqueur which forms an agreeable drink, and acts medicinally as a gentle demulcent. It consists of a sweetened emulsion of almonds, flavoured with orange-flower water. Mucilage of gum-arabic is sometimes

added. The proportions are thus given:—Blanch and pound into a paste half a pound of sweet and half an ounce of bitter almonds, which rub up thoroughly with a pint of clear barley water. Add a pound of powdered loaf-sugar and half a gill of orange-flower water. The French call it *Sirap d'Orgeat*.

O'RIEL. The origin of this term is very obscure. It is, of course, the Old French *oriel*, from the Low Latin *oriolum*, a small room or recess; but whence the Low Latin word comes is not known. Pliny (xxiii. 3), in a passage which speaks of the universal custom of decorating such recesses with gilding, supports the theory of those who would look to *anreolum*, the gilded chamber, as the root of the term. It is applied to that particular kind of bay-window which is made to project from the upper storey of a building, as distinguished from a bay proper, which is a projecting window rising immediately from the ground, whether it be confined to the lower part of the building or carried up through one or more storeys above the ground-floor. Bays generally terminate in either a plain or embattled parapet; but oriels are, for the most part, made to show some sort of roof, either rising behind or resting upon the mouldings which serve as their cornice. Occasionally this roof or crown is rendered an ornamental part of the design, and terminated by some kind of finish.

O'RIEL COLLEGE, OXFORD, was founded by King Edward II. in 1326, for a provost and ten fellows. The number of fellows has been since increased by various benefactions. By an ordinance framed by the commissioners under the statute 17 & 18 Vict. c. 81, the scholars are placed on the foundation of the college; and the preferences in the case of certain fellowships are removed. Under this ordinance there are ten scholarships, tenable for five years; and four exhibitions, called the Exhibitions of Adam de Brome, tenable till the end of the twentieth term from matriculation; the value of each of these scholarships and exhibitions (during residence) being £80 per annum, with rooms rent free. The foundation at present consists of a provost, fifteen fellows, and ten scholars, with twenty-two exhibitors.

No part of the present buildings of this college is of an earlier date than 1620, when the southern and western sides of the ancient quadrangle were rebuilt. The hall and chapel, which are on the eastern side of the quadrangle, were rebuilt between 1637 and 1642. About or soon after this time, the north side was reconstructed and made uniform with the other three sides. Besides this quadrangle, on the east and west sides of the garden are two handsome buildings; that on the east was built in 1719, at the expense of Dr. Robinson, bishop of London; that on the west, called Carter's Building, was constructed in 1729, in pursuance of the will of George Carter, D.D., provost, who bequeathed his whole property to this college, partly for this purpose and partly to purchase advowsons. Between Carter's and Robinson's Buildings stands the Library, begun in 1778, from a design by Mr. James Wyatt. The Common Room of Oriel College contains a picture by Vasari, but is most interesting from its associations connected with the days of the early activity of such men as John Henry Newman, Keble, Arnold, Wilberforce, and Pusey. Oriel also claims the following celebrated men: Bishop Butler, author of the "Analogy of Religion;" Sir Walter Raleigh; and Gilbert White, author of the "Natural History of Selborne."

ORIFLAMME or AURIFLAMME (from the Latin *auri flamma*, flame of gold) was the name applied to the royal standard of France, which had originally belonged to the abbey of St. Denis, and was borne by its protectors, the counts of Vexin. When Philip I. added the county to the dominions of the French crown, the possession of the banner reverted to him, and thus in time it became the standard of the French monarchy. It is said to have

been lost at Agincourt, while other authorities assert that it was last borne in the field in the reign of Charles VII. The banner was cut into flame-like strips at the outer edge, and was carried upon a gilt pole, whence its name. It was charged with a saltire wavy or, and rays issued from the centre crossways. Sometimes this name was bestowed upon flags of less pretension.

ORIGANUM, a genus of plants belonging to the order LABIATE. The species are herbs. *Origanum vulgare* (MARJORAM) is a native of Great Britain in dry uncultivated places, and of Europe, north of Africa, and of middle Asia and America. It is an ornamental and aromatic plant, and yields what is sold as oil of thyme in the shops, a common remedy for toothache. It is also used as a caustic by farriers. *Origanum Majorana* is a tree or shrub in its native country, but an annual in our gardens. It is a native of the north of Africa, near Mascara, on hills, and of India, on the mountains of Kumaon. As the seed seldom ripens in this country, it is generally procured from France. When in blossom, the plant is cut and dried for winter use, as a savoury ingredient in cookery. It is most probable that species of *origanum* are the hyssop of the Bible. See HYSOOP.

In this genus the flowers are arranged in globular or cylindrical spikes, somewhat four-sided, with coloured bracts as long or longer than the calyx. The calyx is tubular, with ten to thirteen ribs; there are four diverging stamens.

ORIGEN (*Origenes*), one of the greatest theologians of the early church, was born at Alexandria, of Christian parents, in the year 185 or 186. As a boy he gave evidence of the possession of remarkable talents, and his father, Leonidas, gave him an excellent education. In the catechetical school of Alexandria he was instructed in the doctrines of Christianity by Pantaenus and Clement, and at the same time he studied Greek philosophy and science under the pagan philosopher, Ammonius Sakkas. In the year 202 a persecution arose, in which his father Leonidas suffered martyrdom, and Origen, then seventeen years old, would have voluntarily shared his father's fate, but for the need of his mother, who was left with six children and no means of support. Aided by a lady of rank, Origen was enabled to resume his studies, and in 203 he was placed at the head of the catechetical school, but as no salary was attached to the office he was compelled to earn his bread by the copying of manuscripts. That he might devote the greater part of his time to his work as student and teacher, he reduced his expenditure to four oboli (2d.) a day, and made this small sum suffice for his bodily wants. Being often in the company of Christian women in his capacity of instructor, and fearing this might be a source of temptation, or at any rate of scandal, he resolved somewhat rashly to render literal obedience to Mat. xix. 12, a step he afterwards regretted, and one which was subsequently used by his enemies in their persecutions. As his fame increased, and pagans as well as Christians thronged to his lectures, he handed over the beginners to his friend Heraklas, and confined his own efforts to those who were more advanced. In addition to his public teaching, he displayed an immense literary activity, and kept numerous secretaries and copyists constantly employed in writing from dictation, and multiplying copies of his works. In this manner he laboured at Alexandria for twenty-eight years, and during this period he undertook numerous journeys for scientific and ecclesiastical objects, visiting at different times Rome, Antioch, Caesarea, Jerusalem, and other places in Palestine. On one of these journeys, probably about A.D. 230, he was ordained a presbyter by some of the bishops of Palestine, who took this method of showing their high appreciation of his learning and labours, and marking their disapproval of the jealousy of the Bishop of Alexandria, who had allowed Origen to remain so long without ecclesiastical honour.

Demétrios, the bishop of Alexandria, was deeply incensed at this infringement of his authority, and he convoked two synods, at which Origen was degraded from his office and banished from Alexandria. He retired to Palestine, where his condemnation had not been acknowledged, and settling in Casarea he soon founded a flourishing school, the fame of which rivalled that of Alexandria. Here he filled the office of presbyter as well as of public teacher, and at the same time he prosecuted his literary work with unabated vigour. He escaped the persecution of Maximin, but when, in the year 250, the Decian persecution broke out, Origen was arrested and imprisoned, suffering much ill-usage at the hands of his captors. He survived this, however, and lived a few years longer, dying probably in the year 254 at Tyre, where his tomb, near the high altar of the cathedral, was shown for many centuries until it was destroyed during the Crusades.

A man of marvellous industry and blameless character, Origen exerted an immense influence over the church during his lifetime, and the theology he founded continued to mould the thought of its teachers for some centuries after his death. As an apologist he had to contend against the opposition of Greek philosophy on the one hand, and Christian Gnosticism on the other; and though he believed himself to be faithful to orthodox his system of thought is unmistakably influenced and pervaded by Neo-Platonic and Gnostic ideas. Hence in later times his teachings were attacked by several of the fathers, and after a prolonged controversy his works came to be regarded as unsound and dangerous, and they were formally condemned by the fifth (Ecumenical) Council at Constantinople in 553.

One result of this condemnation is that most of his works have been lost, and it is only from a comparatively small portion that we can form an estimate of his powers as a writer. Eusebius collected and arranged more than 100 of his letters, and others were preserved in the church library at Jerusalem, but of the whole of his correspondence only two complete letters and two fragments remain. His studies, continued for upwards of twenty years, on the Old Testament resulted in the preparation of the "Hexapla" and "Tetrapla," in which the Hebrew text was placed side by side with six different Greek versions, and the Hebrew in Greek letters, with various readings, prolegomena, and annotations. The "Hexapla" was probably never published in its entirety, but it was used by various scholars at Casarea in the fourth century, and in their works important fragments have been preserved. In addition to his critical labours, he wrote numerous commentaries and homilies on the books of both the Old and New Testaments. Following the method of interpretation then prevalent at Alexandria, he recognized a threefold meaning in the sacred books, every passage being supposed to contain—first, a grammatical and historical sense; secondly, a moral meaning; and thirdly, a concealed spiritual truth. Hence his commentaries, many of which have been preserved in Latin translations, have but little direct value for modern students. His principal apologetic work, a defence of Christianity, in eight books, against the philosopher Celsus, has been preserved entire in the original Greek, and from the evidence it affords as to the condition and work of the Christian church in the second century, it is of inestimable value to the student of ecclesiastical history. It contains nearly the whole of the work of Celsus, to which it is a reply, and it is the only source of information now remaining respecting the ideas and arguments of that philosopher. Of the other works of Origen which are still wholly or partly extant, the most important are his treatises "On the Fundamental Doctrines," "On Martyrdom," and "On Prayer." Of many other important writings, nothing is now left save the names and a few stray references in the works of other authors.

The best edition of the works of Origen is that of Car.

and C. Vinc. Delarue (four vols. folio, Paris, 1733–59, reprinted by Lommützsch, twenty-five vols. 8vo, Berlin, 1831–48). For the best account of the life and labours of Origen, see Redepenning, "Origenes, eine Darstellung seines Lebens und seiner Lehre" (two vols., Bonn, 1841, 1846). There is an English translation of Origen in the Ante-Nicene Library (two vols., Edinburgh, 1870).

ORIGINAL SIN. From a very remote period many and various have been the attempts made to unveil the mystery which surrounds the origin and continuance of evil and sin in the world. The subject of evil generally, including suffering and disaster of all kinds, has received most attention from philosophers, while theologians for the most part have confined their attention to the moral aspects of the question, and have endeavoured to solve the problems involved in the first entrance and the persistence of sin in the world. Some of the philosophical considerations of the question have already been noticed under EVIL, and the present article will deal only with the doctrine of original sin as developed in the church. Passing over the teachings of the New Testament on this subject, concerning which there exists a wide divergence of interpretation, it is evident from the writings of the fathers, that during the first two centuries no very definite doctrine on the subject had been formulated. By most of the Gnostics sin was regarded as a necessary consequence of the contact of the soul with matter, while the orthodox theologians maintained, on the other hand, that it consisted in voluntary disobedience to God. Origen, in his double controversy with the philosophers and Gnostics, was led to the formation of an hypothesis of the pre-existence and pre-mundane fall of each individual soul. Its alliance with the flesh in human life he regarded as part of the divine plan for its redemption; and he anticipated that while from the necessary freedom of the spirit there would ever remain the possibility of transgression, the divine nature of each soul would prevent it from ever being wholly destroyed, and he looked for a universal restoration which should include Satan and the demons as well as men. By the Eastern theologians generally man was regarded as being born free, but subject to temptation; and as Adam fell through voluntary transgression, so each man who sinned fell in the same manner. This doctrine was expounded and defended with much eloquence by Chrysostom and others, and it has ever remained the theory of the Eastern Church upon this subject. In the Latin Church the doctrine took another form, and the conception of "original sin" first propounded by Tertullian grew in course of time into a dogma, which materially affected the whole subsequent development of theology. Two theories respecting the origin of the human soul have been maintained from the first centuries of Christianity to the present day, one known as the Traducianist, which regards the soul as being the offspring of the parents as well as the body; and the other, called the Creationist, which regards God as perpetually creating souls and infusing them into bodies. Tertullian held strongly the Traducianist theory, and he maintained that "the soul propagates itself, with all its defects and faults, as matter is propagated;" thus introducing the doctrine of original sin, or the inheritance of a sinful nature by each human being. In this view he was followed by Cyprian and Ambrose, but it was left to Augustine to fully develop the doctrine in his controversy with Pelagius. The latter, who rejected the Traducianist theory, and who regarded each soul as the direct creation of God, maintained that sin could not be physically propagated; that each man is a moral agent complete in himself, that he is born free and innocent, and that all transgression implies a voluntary submission to evil. Augustine, on the other hand, laid down the doctrine that the fall of Adam involved the whole of his posterity, and that "as all men have sinned in Adam, they

are justly exposed to the vengeance of God, because of this hereditary sin and guilt of sin." In the conflict Augustine and his supporters gained the upper hand, and they procured the condemnation of their opponents at the councils of Carthage in 412, 416, and 418; but the doctrine they propounded never received acceptance from the Eastern Church. In the West most of the schoolmen followed Augustine, though some, who shrank from the harsh and repulsive features of his doctrine, attempted to compromise matters and to propound a theory, called by its opponents semi-Pelagian. Others, while accepting the essential principle of the Augustinian theory, added to it many limitations and explanations, one of the most important of the modifications being that introduced by Anselm of Canterbury. At the period of the Reformation the doctrine of original sin was brought prominently to the front, the Augustinian doctrine being revived by Luther, and restated with additional harshness by Calvin. Most of the Reformed churches accepted the Augustinian, or as it came to be called the Calvinist theory, and at the present day it is still the professed creed of a very large section of the Protestant churches. In Calvin's "Institutes," ii. 1, it is asserted that, "It is certain that Adam is the root of mankind, and all the race vitiated by his corruption." "By this corruption we are justly condemned in the sight of God." "Infants bring their condemnation into the world with them, for their nature is a seed of sin. The authorized Anglican doctrine on the subject is given in Article IX. of the Thirty-nine Articles, and a still more complete definition of the doctrine is given in the Westminster Confession, which is still accepted as a doctrinal standard by most of the Presbyterian churches. In chap. vi. of the latter it is declared that "Our first parents sinned in eating the forbidden fruit." "They thus became dead in sin and defiled in all the faculties and parts of soul and body;" "They being the root of all mankind, the guilt of this sin was imputed, and the same death in sin conveyed to all their posterity descending from them by ordinary generation. From this original corruption, whereby we are utterly indisposed, disabled, and made opposite to all good, and wholly inclined to all evil, do proceed all actual transgressions."

On the other hand the Roman Catholic Church, at the Council of Trent, accepted as the orthodox doctrine the so-called semi-Pelagian theory affirming that "the fall caused only the loss of the divine gifts, the natural consequence of which is man's imperfection and infirmity." A similar doctrine was maintained by the Arminians, Socinians, and Quakers, the latter rejecting the term original sin altogether.

The extreme Augustinian view finds but few defenders in the present generation, and even those who outwardly accept it as part of their creed are for the most part reserved as to its discussion. By the more liberal theologians of modern times, the Pelagian doctrine is generally maintained, but few of them care to define any theory upon the subject.

The various doctrines formulated upon this subject, and the controversies to which they have given rise, viewed historically, are not without instruction to those who would trace the growth and progress of human thought, and this indirect value is now nearly all that remains. Beneath the doctrinal and theological vestures, however, we may recognize an attempt on the part of the thinkers of the church to explain certain features of human life, the study of which has now passed from theology to science. Never before has the subject of hereditary tendency been so carefully and patiently studied as at the present day, and apart from all doctrinal considerations it is universally admitted that the result of ancestral crime is depravity of constitution, diseased blood, nerves, and brain, and the existence of tendencies which, unless strongly restrained, tend to reproduce the iniquity. At the same time it has been

observed that good qualities are transmitted as well as evil, tendencies towards virtue as well as towards vice, and while in a *speculative* sense some may continue to accept the doctrine that all men are born "opposite to all good and wholly inclined to all evil," it is never allowed to enter into the practical relations of life, even by the most rigid Calvinists.

ORIHUELA, the ancient *Orcelis*, a city of Spain, in the province of Alicante, is situated on the banks of the Segura, in an extensive plain at the foot of a lofty mountain of limestone, which overhangs it precipitously on the north. The city, which gives title to a bishop, is 7 miles from the coast of the Mediterranean, and 96 miles S.S.W. from Valencia. The population is about 20,000. Besides its cathedral, Orihuela has several parish and dependent churches, three hospitals, a theatre, a public granary, and cavalry barracks. Its institutions for public instruction are a university, an ecclesiastical seminary, two colleges, and several libraries. The city is divided by the Segura into two parts, which communicate by two bridges. In form it is long and narrow, winding round the base of the mountain La Muela, which overhangs it. The streets are straight and broad; they are not paved, but strewn with sand, which is taken from time to time to manure the land in the vicinity, and replaced by a fresh layer. The houses are for the most part regular and tolerably handsome, and the general aspect of the city is cheerful and agreeable. The inhabitants have a thriving commerce, and manufactories of linen, silk, hats, soap, and starch, some tanneries, flour mills, and more than 100 oil mills. The plain in which the town stands forms part of the *huerta* or plain of Murcia, and is one of the most beautiful and most productive spots in the kingdom, or perhaps in the world. From its fertility it is called "the garden of Spain."

Orihuela is supposed to have existed prior even to the Carthaginians, from whom it passed successively to the Romans, Goths, and Moors. In 1057 it was made the capital of a small kingdom subordinate to the caliphate of Cordova. In 1228 it became annexed to the Moorish kingdom of Murcia, and finally, in 1265, fell by conquest into the hands of James I., king of Aragon.

ORINOCO, a large river of Venezuela, South America, which has its origin on the southern declivity of the eastern part of the mountain system called Parime, and a total course of 1960 miles. It rises near 64° W. lon., and between 3° and 4° N. lat. About 150 miles from its source it divides into two arms, of which that which flows to the south-west is called Cassiquinari, and after a rapid course of nearly 100 miles joins the Guainia or Rio Negro, thus forming a natural water-communication between the Orinoco and Amazon, into which latter river the Guainia falls. The Orinoco continues a wide river, and follows a tortuous course to Angostura, a little below which the delta begins, 150 miles from the ocean. The river sends off to the north a branch, which soon divides into a great number of other branches, all known by the general name of Bocas Chicas ("small mouths"). They are all narrow when compared with the principal branch of the river, called Boca de Navios ("ship's mouth"); but most of them are deep enough to admit vessels of considerable size. The Bocas Chicas empty themselves partly into the Atlantic and partly into the Gulf of Paria, between the continent of South America and the island of Trinidad. The Boca de Navios runs eastward to the ocean, and is divided for a distance of about 40 miles into two channels by a series of islands which lie nearly in the middle of the stream. From this point further down the breadth continues to increase, and at the mouth, between Punta Barina on the south and the island of Cangrejos on the north, it is more than 60 miles wide.

The Orinoco contains numerous islands, cataracts, rapids, and whirlpools. The tides are perceptible to a distance of

250 miles from its mouth. At 200 leagues from the ocean its breadth is about 3 miles, and at Angostura it is 4 miles across, and, when lowest, 65 fathoms deep. It gradually rises every year, from March to September, usually from 24 to 25 feet at Angostura; but in the upper part of its course the rise is several feet higher. It is lowest in January and February. Its banks are covered with dense forests, which, like its waters, abound with animal life.

The tributaries of the Orinoco are very numerous, and many of them have both a long course and a great volume. Those which join it on the left are navigable through nearly the whole of their course, and are rarely impeded by rapids; but the rivers which fall into it on the right, originating on the elevated region of the Parime Mountains, descend by numerous rapids and cataracts, so as to be, at least for a great part of their course, entirely unfit for navigation. The chief of the tributaries from the left are—the Guaviare, 450 miles; the Rio Meta, 500; the Rio Apure, 500; and from the right the Caroni, 400 miles. The Orinoco, with its western affluent the Meta, forms a magnificent and important water highway, navigable for steamers and sailing vessels all the way from the Atlantic Ocean to the Colombian Cordilleras. This great river is especially suited to form a commercial route, by the fact that the trade winds prevail inland as far as San Fernando, enabling sailing craft, though slowly, to make head against its downward current.

ORIOLE (Oriolidae) is a family of Passerine birds belonging to the group Maguirostris. The orioles are restricted to the Old World, inhabiting Europe, Asia, Africa, and the islands of the Indian Archipelago. Wooded districts are their favourite localities, and their food consists of insects, larvæ, fruits, and berries. Yellow and black are the prevailing colours of the males in adult plumage; but the females and young are tinged with greenish olive, more or less clouded.

One species only, the Golden Oriole (*Oriolus galbula*), breeds in Europe, and is an occasional spring visitor to our



Golden Oriole (*Oriolus galbula*).

island. In winter it departs to South Africa. During the breeding season these birds live in pairs, assembling in small flocks previous to migration. The nest is cup-shaped, composed of long grass and wool beautifully interwoven; it is generally suspended by its rim from the fork of some branch. The eggs are white, or purplish-white, with dark brown or claret-coloured spots. The golden oriole is about 9 inches in length. The general plumage of the male is bright yellow, with the wings and tail black, more or less variegated with yellow, and with a dark streak running from the bill to the eye; the female is olive-coloured above, grayish-white beneath, with the wings and tail brown.

ORION was a handsome giant and hunter of Boötia, son of Huriens. According to some Fōs (the dawn-goddess) loved him, and carried him off, whereupon Artemis slew him. According to others it was Artemis herself who fell in love with him, and Apollo her brother who was angry. Apollo, when persuasion had failed, devised an ingenious

method of preventing his sister's marriage, as follows:—He asserted that she could not hit a black object which appeared in the sea at a distance; and she, being a good marksman, showed him immediately that she could. This black object, however, was the head of her lover, who was swimming at the time; and to console her for the evil results of her well-directed shot, the dead lover was immediately placed among the stars, with his club and lion's skin.

ORION, the constellation, is surrounded by Eridanus, Canis Major, Gemini, Auriga, and Taurus. The position of his belt, with respect to Aldebaran and Sirius, and the proximity of Procyon, Castor and Pollux, the Pleiades, &c., render it difficult to forget and unnecessary to describe this part of the heavens. Of Orion's stars, α and β , of the first magnitude, are frequently called Betelgeux (*ib-al-jauza*, the shoulder) and Rigel, corruptions from Arabic names; γ is called Bellatrix. (See **PLATE CONSTELLATIONS**, Northern and Southern Hemispheres, the constellation being divided by the margin at the point "June, vi.") The constellation Lepus or the Hare, beneath Orion, formerly stood for the chariot in which he was hunting. The Great Nebula lies on the Sword, beneath the well-known Belt of three fine stars. On clear nights the dappled light of the Milky Way is seen over a great part of this most magnificent and interesting of all the constellations. Betelgeux is one of the most perplexing variable stars in the heavens; Rigel is a very fine double star. Besides the Great Nebula, the central star of the Belt and the lowest star of the Sword are nebulous, and all these things are perpetual objects of study. The Arabic name of Orion is Algebar.

"Begirt with many a blazing star
Stands the great giant Algebar,
His sword hangs gleaming by his side,
And on his arm the lion's hide
Scatters across the midnight air
The golden radiance of its hair."

ORISSA, a province of British India, forming a division or commissionership under the jurisdiction of the Lieutenant-governor of Bengal; situated between 19° 28' and 22° 34' N. lat., and between 83° 36' and 87° 31' E. lon. It forms the extreme south-western portion of the Bengal Presidency, being bounded on the N. and N.E. by Chutia Nagpur and Bengal Proper; on the E. and S.E. by the Bay of Bengal; on the S. by Madras; and on the W. by the Central Provinces. It contains a total area of 23,901 square miles, and a population of 4,500,000. Orissa consists of two distinct territories—a fertile alluvial delta, comprising the three British districts of Cuttack, Balasor, and Puri; bounded on the E. and S. by the sea; and on the W. and N. by a wild region of sparsely populated Tributary Hill States, which walls it out from the Central Indian plateau.

The Orissa delta is formed from the deposits of three great rivers—the Mahanadi on the south, the Brahmani in the centre, and the Baitarani on the north. The three rivers gradually converge towards the coast, and dash down their accumulated waters, within 30 miles of each other, upon Orissa. During summer their upper channels in the interior table-land dwindle to insignificant streams, dotted here and there by stagnant almond-shaped pools.

Agriculture.—Rice is the great crop of Orissa. The husbandmen have developed every variety of it, from the low-growing plant, 12 inches high, to the low-stemmed paddy, which rears its head above 6 or 7 feet of water. Their skill in tillage has adapted this cereal to all classes of soil, from the dry uplands to the deep swamps. One variety is sown on low lands in December or January, and is reaped in March or April; another is sown on high lands in May or June, and reaped in July or August; a third, sown at the same time, is reaped in September; a fourth, sown on lands of middling elevation, is reaped in October;

a fifth, sown on low lands throughout the whole province at the beginning of the rains, yields the great harvest of the year in December. Besides rice they have wheat, many varieties of pulse and pease, oil-seeds—especially mustard—hemp, tobacco, cotton of two sorts, three varieties of sugar-cane, the costly betel-leaf, tubers, and vegetables of many kinds.

Orissa owes to its rivers, not only its rare deltaic fertility, but also some of the greatest calamities which can afflict a country. Besides its copious water supply, amounting to a discharge of 2,760,000 cubic feet per second in time of floods, Orissa has a local rainfall of 62½ inches per annum. Nevertheless, the uncontrolled state of the water supply has subjected the province, from time immemorial, to droughts no less than to inundations. A flood in 1866 destructively inundated 1052 square miles of the delta, the waters lying from 3 to 15 feet deep in most parts for thirty days, submerging the homesteads of 1,300,000 husbandmen, and destroying crops to the value of £3,000,000 sterling. The province was just emerging from the terrible famine of 1865-66, which swept away one-fourth of the whole population, and the people were looking forward to the approaching harvest as their one chance of safety, when this outbreak took place. This inundation does not stand alone. Eleven years previously, an equally ruinous flood had buried the country deeper in water, and forty years earlier a tidal wave and river inundation had completely desolated a large part of Balasor district. The floods and droughts of Orissa constituted a yearly charge upon the revenues of the province, exceeding in absolute outlay three times the whole revenue derived from the inhabitants of the Tributary States. Engineering skill may ultimately solve the great problem of checking the flood-water before it reaches the lower levels, and thereby free the country from the misery and desolation such calamities bring upon it. Much has already been done by government to husband the abundant water supply.

Religion.—From the moment the Hindu crosses the Baitarani River he treads on holy ground. On the southern bank of the river rise shrine after shrine to Siva, the all-destroyer. On leaving the stream he enters JAGANNATH, literally the "city of sacrifice," the headquarters of the region of pilgrimage sacred to the wife of the All-destroyer. There is not a fiscal division in Orissa without its community of enobites, scarcely a village without consecrated lands, and not a single ancient family which has not devoted its best acres to the gods. Every town is filled with temples, and every hamlet has its shrine. The national reverence of the Hindus for holy places has been for ages concentrated on Puri, sacred to Vishnu under his title of Jagannath, the "lord of the world." It has been estimated that sometimes as many as 300,000 pilgrims visit Puri in the course of the year, the car festival alone having been attended in some seasons by upwards of 90,000.

History.—The conquest of Orissa by the English formed part of the great campaign against the Marhattas in Central India undertaken by the Marquis of Wellesley. The original plan was that the force, after capturing Cuttack, and leaving a sufficient number of troops to hold it, should make its way by the Barmul Pass through the Tributary States, and co-operate with General Sir Arthur Wellesley in Berar. The main body of the expedition started from Ganjam in September, 1803, and on the 18th entered Puri without opposition. On the 14th October, the fort of Cuttack was taken. Equal success attended the expedition which had been despatched from Bengal against the town of Balasor.

The three principal towns of the province having fallen into the hands of the English, a part of the force was, in pursuance of the original plan of the campaign, despatched under Major Forbes to force the Barmul Pass. This detachment had penetrated through the hilly and jungly

country which bounds Orissa on the west, and reached the Pass of Barmul, the key to Berar and the Central Provinces. Here the Marhattas made a last stand; but on the 2nd November, 1803, the pass was forced, and the enemy, completely broken and defeated, escaped with difficulty across the hills. The Rajahs of Bod and Sonpur, in consequence of this defeat, came to render their submission to the British. Meanwhile, Colonel Harcourt was approaching from the east with the intention of effecting a junction with Major Forbes, and leading the combined force to co-operate with Sir Arthur Wellesley in Berar; but news having come that peace had been concluded both with Sindhia and the Marhatta Rajah at Nagpur, the troops marched back to Cuttack, and the force was broken up early in 1804.

Colonel Harcourt and Mr. Melville, as joint-commissioners, thereupon set about placing the civil administration of Orissa on a satisfactory footing. Courts were established, a land settlement arranged for, and the Bengal Civil Regulations extended to the province. The office of the "Commissioners for settling the Affairs of Cuttack" was abolished in 1805, and Orissa was placed under the charge of a collector, and of a judge and magistrate. The headquarters of the province, which then consisted of only one district, were at Puri until 1816, when they were removed to Cuttack. In 1829 this unwieldy jurisdiction was split up into the three districts of Cuttack, Balasor, and Puri, with the non-regulation Tributary States.

ORKNEY ISLANDS, a group of islands belonging to Great Britain, forming the more southerly part of the county of Orkney and Shetland. They are situated north of the north-eastern extremity of Scotland, and are divided from the mainland, the county of Caithness, by the Pentland Frith, which is 6 miles wide at its eastern and 7 miles at its western entrance.

The group consists of seventy-three islands and islets, counting every one that has flowering plants growing on it, but seventeen of these become peninsulas at low water, and only twenty-eight are inhabited. The largest of the islands, called Pomona or Mainland, extends from south-east to north-west about 25 miles, and divides the group into two portions. The islands between Pomona and the mainland of Great Britain are called the South Isles, and those north of Pomona the North Isles. The total population of the Orkneys in 1881 was 32,044, of whom rather more than half were in the Mainland.

Some of the islands, especially those on the west, have rocky shores, presenting abrupt precipices. They also have low rounded hills covered with heath, with a considerable depth of peat-mould. Others are low and flat, with sandy shores. There are no trees on any of them, with the exception of a few of small size in the neighbourhood of the town and port of KIRKWALL. The geological character of these islands is very simple; the whole group, with the exception of a small granitic district near Stromness, consisting of rocks belonging to the Old Red Sandstone formation, and abounding with fossils.

The island of Sanda, which is flat and low, is the most fertile, and accordingly is called the granary of the Orkneys. On the north-east extremity of this island, at Start Point, a lighthouse has been erected. Ward Hill, on the island of Hoy, has an elevation of 1564 feet, and terminates on the west side in a precipice above 1000 feet high. Hoy itself is 14 miles long by 5 broad, and has a harbour and some fine cliff scenery. Weekly steam communication is maintained between it and Leith. The coasts of Pomona and the South Isles are very irregular in their outline, and contain several secure and spacious harbours.

The Orkneys are exposed to the western gales from the Atlantic, which are the prevalent winds, and the climate is rather wet than cold. Frost rarely continues for several days in succession, and the harbours are open all

the year round. The temperature generally is remarkably equable, owing to the surrounding ocean. The soil of some of the islands is of inferior quality, but that of others is excellent. Agriculture is limited to the raising of oats and that kind of barley which in Scotland is called *bera* or *bigg*, and to the cultivation of potatoes, turnips, and a few other vegetables, but great improvements have been made in the system of farming in modern times. Much of the heath and moor has been improved, and there are now many tracts, several miles long, of fertile and well-cultivated lands, with fresh-water lakes. Cattle and horses are numerous, but small. Many families subsist entirely on the produce of their fishing; cod, herrings, and lobsters abound along the coast, and seals are common.

The inhabitants are of Scotch and partly of Norwegian descent. It appears that the Orkneys were examined by Agricola, 81 A.D., and early taken possession of by the Normans. They remained subject to the kings of Norway and Denmark till the year 1468, though they had their own kings or earls, who governed them as independent sovereigns. The islands were the general rendezvous of the piratical fleets which so often devastated the coasts of England and France. Rollo, the conqueror of Normandy, and ancestor of William the Conqueror, was an Earl of Orkney. From the year 1471 the earls became dependent on Scotland, and from that time were considered like other chieftains of the Scottish clans. The Earl of Bothwell was created Duke of Orkney by Mary Stuart, but did not long enjoy the title. Pomona contains in the parish of Steenness, near its centre, the famous antiquities called "the Standing Stones of Steenness," and Maes Howe. The latter was excavated in 1861, and there are about 1000 Runes or Runic letters inscribed on the walls.

The Orkney Islands and Shetland Islands together constitute one of the counties of Scotland, called the county of Orkney and Shetland, the area of which—deducting, so far as is practicable, the area of the channels between the islands—is 935 square miles, or 598,726 statute acres. It returns one member to the House of Commons. The burgh of KIRKWALL, the only town, is a member of the Wick district, which also returns one member.

ORLANDO (the Paladins). See **ROLAND**.

ORLANDO DI LASSO. See **LASSO**.

ORLE, one of the subordinaries in **HERALDRY**, differs from the bordure in being detached from the side of the shield. It is therefore a band following the outline of the shield at a little distance within. Charges arranged in this fashion are also said to be "in orle."

ORLÉANAIS, one of the old provinces of France, now forms the departments of LOIR-ET-CHER, LOIRET, and portions of those of EURE-ET-LOIRE and NIÈVRE. It was formerly divided into Orléanais Proper, capital Orléans; Gatinais, of which Montargis was the chief town; Beauce, capital Chartres; Dunois, chief town Châteaundun; Vendômois, and Blaiosis, of which the respective capitals were Vendôme and Blois; and Sologne, of which the chief town was Romorantin.

ORLEANS (*Orléans*), the capital of the department of Loiret, is situated on the right bank of the Loire, 75 miles by railway south by west from Paris, 70 north-east from Tours, and had 57,264 inhabitants in 1882. This town occupies the site of the ancient *Aurelianis* (so called in honour of the Emperor Aurelian, by whom it was embellished), which, according to D'Anville, had the earlier name of Genabum, a town plundered and burnt by Julius Cæsar ("Bell. Gall." vii. 3-11); but some antiquarians contend that Gien occupies the site of Genabum. It was besieged by Attila in 451, but relieved by the Romans commanded by Aëtius, who defeated Attila under its walls. Orleans subsequently passed into the hands the Franks, and became the capital of the petty kingdom of Burgundy. The Normans captured it in 855, and again in 865. On the

accession of Hugues Capet, who had inherited the duchy of Orleans, the town became one of the most important places under the crown. It was besieged in 1428 by the English under the Duke of Bedford; but they were obliged to raise the siege, and never after recovered their superiority. [See **ARC, JOAN OF**.] The town has frequently given the title of duke to members of the royal house [see the articles **ORLEANS, DUKES OF**; and **ORLEANS, HOUSE OF**]. The town suffered much during the religious wars of the sixteenth century, and again in the Franco-German War of 1870, when it was the scene of the only French victory.

The town stands in a plain gently sloping down to the river: the ramparts, which are now converted into a promenade, form an arc of a circle about 3 miles in extent. The side of the town along the bank of the Loire is about $1\frac{1}{2}$ mile long, and the length of the principal street from the north entrance to the bridge over the Loire is about three-fourths of a mile. Orleans is surrounded by numerous country-houses, and has large suburbs, of which that of Olivet is on the south side of the river. Some parts of the town are well laid out, with wide and clean streets and well-built houses. The line of streets from the Paris road to the bridge is on the whole the finest, especially the part which lies between the bridge and the Place du Martroy, in which is erected an equestrian statue of Joan of Arc. But in the older parts of the town the streets are ill laid out and ill paved, and the houses are built generally of wood. The bridge over the Loire is 1089 feet long, and consists of nine arches, of which the central one has 108 feet span. There is a handsome quay near the bridge; and between the bridge and the suburb of Olivet is a public walk. This suburb abounds with country-houses and with nursery grounds.

The Gothic Cathedral of Sainte Croix is one of the finest religious edifices in France. The present structure was commenced by Henry IV. The architecture has excited much admiration, especially that of the portal entrance; the two towers of the front are of surpassing elegance and lightness. The Church of St. Agnan, the finest except the cathedral, is a beautiful Gothic building, although now without nave or steeple. The Church of St. Pierre-le-Puellier, the oldest in the town, is notable only for its antiquity. Other remarkable structures in Orleans are—the Church of St. Euvverte, now used as a store-house, while the tower is turned into a shot-foundry; the chapel of St. Jacques, now a salt store; the old town house, now converted into a museum and picture gallery; the house of Agnes Sorel in the Rue du Taboury; the court-house; and the house of François I. in the Rue de Recouvrance. The town has a public library of 50,000 volumes, a theatre, and a botanic garden.

The chief manufactures are—hosiery for exportation to the Levant, refined sugar, vinegar, bleached wax, blankets, and counterpanes. To these articles of manufacture must be added cotton and woollen yarn, fine woollen cloths, flannels, saltpetre, hats, files, rasps, and other tools, glue, leather, tinware, and earthenware. There are numerous breweries, dye-houses, and metal foundries. The city has also an extensive commerce in the wine, brandy, and vinegar of its district; and in corn, flour, wool, hides, iron, salt, hoops, dye-stuffs, saffron, firewood, timber, oak planks, coals, groceries, and spices. Its situation on the Loire, which is navigated by small steamers, and which communicates with the Seine by means of canals, and on the railway, to which the lines connecting Bordeaux, Nantes, and the centre and south of France with Paris converge—renders Orleans the centre of a very considerable commerce and of a large transit trade.

Orleans gives title to a bishop, whose see is the department of Loiret. It is the seat of a High Court and of a University Academy, which have jurisdiction over the departments of Indre-et-Loire, Loiret, and Loir-et-Cher.

The hospital and medical school are among the finest in France. The town also possesses civil and commercial tribunals, an exchange, national, Catholic, and Protestant colleges, a council of prud'hommes, and gratuitous schools of design and architecture. The valley of Orleans was devastated by an inundation of the Loire in 1816. The city was the birthplace of Robert, king of France, and of Pothier.

ORLEANS, DUKES OF, princes of the blood royal of the Bourbon dynasty of France.

LOUIS, DUKE OF ORLEANS, the first to be noticed bearing this title, was the son of Charles V. (the Wise) and the brother of Charles VI. (the Well beloved). He was born in 1372, and had the honour of possessing the great Constable Du Guesclin as his godfather. When Charles V. came to the throne Crécy and Poitiers had laid France at the foot of England; when he left the kingdom to Charles VI. it was nearly free, thanks chiefly to the grand qualities of Du Guesclin. But meanwhile all the flower of the French nobility had perished. Great disorders overspread the land. The worthless paternal uncles of the young King Charles VI., the dukes of Burgundy, Berry, and Anjou, and his mother's brother, the excellent Duke of Bourbon, disputed the regency, until Anjou set out on his disastrous expedition to recover his alleged inheritance of the kingdom of Naples, and Berry settled down as governor of Languedoc, which he literally plundered. Charles had given way to dissipation, and thus weakened could no longer stand the continual turmoil which raged around him. In 1392, still only twenty-four years of age, he became mad. The Duke of Burgundy, his uncle, seized the regency, and endeavoured to exclude the king's brother (who had been created Duke of Orleans in 1391) from the council. He did worse than this. Louis of Orleans had married, first, Mary of Hungary, and had taken the title of king of that country when a boy of thirteen (1385), but both his title and his wife were definitely taken from him by Sigismund. He had later on consoled himself with Valentina, daughter and heiress of Visconti, duke of Milan (1389), and this princess was cruelly charged by the reckless Burgundy with having bewitched the king, and dismissed from court for having thus caused his illness. The truth was that she was very kind to the afflicted young man, and had become dangerous to the regent's power. Nevertheless the influence of Burgundy paled before that of Orleans, who now led the party of the queen (Isabeau of Bavaria), and soon became the chief personage in the kingdom. Orleans' old rival, Burgundy, died in 1404; but the hatred of the new duke was even fiercer, and in 1405 he took up arms against Orleans and the queen, who retired to Melun. Burgundy was supported by the common people. He succeeded in seizing the persons of the royal children and carrying them off to Paris, and drove the royal party very hard. After many attempts he was successful at last in procuring the murder of Orleans, whom he had treacherously invited to a meeting of reconciliation, 24th November, 1407. The unhappy Valentina cried for vengeance, but was driven from France by the assassin, who loudly avowed his crime in full council.

THE BASTARD OF ORLEANS, the famous Jean, count of Dunois, was the illegitimate son of this duke. He was born at Paris in 1402. He figures largely in the first part of Shakespeare's "Henry the Sixth," for it was he who held Orleans against the English till its relief by Joan of Arc in 1429, and who, together with the Constable, took Paris from the English in 1436. He again defeated us in our later disasters in France at Castillon in 1451, and completed the reconquest of Guienne in the same year. He withstood the schemes of Louis XI. on his accession, at the head of the "League for the Public Good," but eventually concluded with the king the treaty of Conflans, which gave peace to France in 1465. He died 1468.

CHARLES, DUKE OF ORLEANS, son of the above first Duke Louis, is known best to us as a poet of consummate elegance, both in English and in French. He was born in 1391; married Isabella, the widow of Richard II. of England in 1406, and succeeded to the title on the murder of his father in the streets of Melun, November, 1407. He married in 1409 the daughter of the Count d'Armagnac, who at that time disputed the regency of France with the Duke of Burgundy, and was actively engaged in the Civil War in 1410. He went so far in his animosity against the Burgundian faction as to ally himself with Henry IV. of England by a formal treaty in 1412. The invasion of Henry V. of England drew the rivals together against the common enemy, and Orleans fought side by side with his former foe most bravely at Agincourt (1415), as Shakespeare generously tells of him in "Henry the Fifth." He was taken prisoner by Henry V., and brought to London, and remained in honourable captivity in England for twenty-five years. He wrote both in French and English at this time. Set free in 1440, he retired to Blois, where he drew to him the best literary artists of the time, from Bouciquault to Villon, engaging with them in poetical tournaments. Much of his work is lost, but what is left is delightful. Few early French poets are so well known, except perhaps Villon, and none are so graceful and pleasant. The antique forms of verse called the rondeau, ballade, &c., are pliant in his hands, and their recurrent refrains are most beautifully and quaintly varied. The most often quoted is the rondeau on the approach of spring:—

"Le temps a laissé son manteau
De vent, de froidure, et de pluie,
Et s'est vêtu de broderie
De soleil luyant, clair et beau," &c.,

which is not to be surpassed in its kind. Charles d'Orleans died at Amboise in 1465.

LOUIS, DUKE OF ORLEANS, son of the above, born at Blois in 1462, succeeded to the title in 1465. Being next heir to the throne, after the Dauphin Charles (afterwards Charles VIII.), he was carefully watched by the unscrupulous Louis XI., who went so far as to marry him to the Princess Joan, his daughter, well knowing that she could never bring heirs to Orleans. The death of Charles VIII., without children, brought the Duke of Orleans to the throne as **LOUIS XII. OF FRANCE**. On the accession of Louis XII. the title of Orleans became merged in the crown of France.

Francis I., duke of Angoulême, succeeding the childless Louis at his death, bestowed the title of Orleans on his eldest son Henry, afterwards Henry II., husband of Catherine de Médicis. Again, therefore, the title was absorbed, until Henri Quatre gave it as an appanage to his third son, Gaston, the younger brother of Louis XIII.

GASTON, DUKE OF ORLEANS. Jean Baptiste Gaston of France, duke of Orleans, was born at Fontainebleau in March, 1608, and was at first created Duke of Anjou, receiving the title and revenues of Orleans on his marriage with Mlle. de Montpensier in 1626. Their only child was the famous Mlle. d'Orleans (or de Montpensier), usually called La Grande Mademoiselle, who took towns, wrote memoirs, bearded Louis XIV., and all in the most consummate style, as became the grand-daughter of Henri Quatre. So long as Anne of Austria remained childless, Gaston of Orleans was heir to the crown. Louis XIII. feared his brother's greater talents and the boldness with which he used them, and carefully marked his distrust. In consequence, offended at the practical regency of the Cardinal de Richelieu, who had usurped the place he deemed his own, Gaston organized a formidable conspiracy in 1626. He proceeded with his usual rashness, was quickly discovered, and many of the best heads in France fell. (This conspiracy is made the basis of the well-known play of Lytton, "Richelieu.") The duke was pardoned, and made his peace by

resisting the English at La Rochelle. But quarrels soon arose between him and the cardinal, and eventually, in 1631, he broke out into open civil war, assembling an army of 2000 in Flanders. He was utterly routed by Marshal Schomberg at Castelnaudary, and fled to Lorraine. Here he married the duke's daughter, Marguerite. He quarrelled with her and left her, proceeding to Brussels, and eventually making his peace with his brother in 1632. Richelieu bitterly revenged himself upon the Duke of Lorraine, being powerless to alter the king's leniency towards his brother, and on a fresh outbreak of the latter and a fresh retirement to Brussels, procured the invalidation of his marriage in 1634. Nevertheless Marguerite rejoined him at Brussels almost at that time, and he entered into intrigues with Spain and conspiracies, such as that with Cinq-Mars, to assassinate Richelieu in 1612. He even concluded a treaty with Spain. Gaston betrayed Cinq-Mars as the price of his own liberty; the cardinal had no proof against his victim otherwise. Richelieu died the same year, and Louis XIII. at once reversed all his policy, among other things receiving into favour the trencherous, vacillating Orleans. He even nominated him lieutenant-general of the kingdom in case of his own death. This occurred the next year (1643), but the duke's authority was quickly set at naught by Anne of Austria, the queen-mother, and by the Cardinal Mazarin, the protégé and successor of Richelieu. Thereupon the duke, who had in the meantime served brilliantly in Flanders against the Spaniards, formed the party of the Fronde, and that most remarkable of civil wars, often almost a mockery of polite passions, but sometimes only too real and too full of bloodshed, divided France for some time. It is somewhat difficult to trace the duke's selfish career for the next few years, blockading Paris with Condé in 1649, consenting to the imprisonment of Condé, Conti, and Longueville in 1650, liberating them all with assistance from Spain in 1651, and again deserting them. Finally, on his joining Condé in arms in 1652, it was felt that he had exceeded all possible bounds; and as soon as the war was over he was banished to Blois, where he remained till his death in 1660. His marriage with Marguerite of Lorraine had been re-solemnized in 1643, but the fruits of the union were all daughters; and as his first wife had borne him only La Grande Mademoiselle, the title again lapsed to the crown.

Once more Orleans became a princely appanage, and once more it was to provide a wearer of the crown of France. On the death of his uncle Gaston, Louis XIV. created his own brother Philippe Duke of Orleans, and from him the usurping king, Louis Philippe, and the present rightful claimants to the Bourbon throne are descended.

ORLEANS, HOUSE OF, a branch of the royal house of France, now, since the Bourbon (elder) branch has died out in the person of "Henry V.," the Comte de Chambord, the legitimate heir of the ancient French monarchy. The present house dates from Philippe (born 1640), who on the death of his uncle Gaston, duke of Orleans, in 1660, without heirs, was created Duke of Orleans by his brother, Louis XIV. He married Henrietta, the handsome daughter of Charles I. of England, in the following year, and after her somewhat mysterious death in 1670 he married a princess of Bavaria. He became Duke of Nemours in 1672 and of Montpensier in 1693, both family titles being afterwards well known through Louis Philippe conferring them upon his younger sons. Philippe of Orleans took part in the conquest of Holland in 1672-77, and even defeated the Prince of Orange; he took part also in the taking of Mons (1691) and Namur (1692), but the jealousy of Louis XIV. prevented him from fully manifesting his great talents. He died in 1701, and his son Philippe succeeded him in his many titles.

Philippe II. was the famous, or rather notorious, *Regent of Orleans*. On the death of Louis XIV. (1715)

his nephew found himself named president of the council of regency governing for the young king, Louis XV., great-grandson of the late monarch. Philippe of Orleans soon converted his office into an absolute regency. He was very popular, handsome, brilliant, and exceedingly clever; and his ill-treatment by his uncle, the later part of whose reign was not only tyrannical but unsuccessful and dull, rendered him all the more the darling of the people. Louis XIV. had compelled him to marry Mdlle. de Blois, the king's natural daughter by Mme. de Montespan. The duke and his tutor, Cardinal Dubois, exhausted every form of debauchery; consequently every one was astonished when this debauchee put forth a claim to the throne of Spain, which he prosecuted so vigorously, and with such a good prospect of success, losing no chance of showing his considerable military talents, that his uncle, alarmed, dismissed him into semi-banishment. His studies in chemistry were even made the handle for a cruel insinuation, which he was refused the right of bringing to the test, that he was privy to the poisoning of the Grand Dauphin and others of the royal family, who died not of poison but of the malignant fever which decimated the court in 1711. The acts of the regent were vigorous. He began by barring the succession to the legitimized crew of bastards of the late king; negotiated favourably with George I. of England, and in many other ways did well. But he soon gave over the reins of power to the vicious Dubois, and amused himself in unlimited intrigue and debauchery. The secret history of the time is sickening to read, all the more that this duke was really at bottom a man of good heart and of great talent. The financial distress, begun by the extravagance and the costly wars of Louis XIV., compelled measures to be taken. Unhappily the regent was led away by Law, the famous Scotch adventurer, who, in 1716, started a general bank, followed by the Mississippi scheme in 1719, and was made controller-general in 1720. Terrible evils came from the regent's lending a ready ear to Law's projects, and he was soon as unpopular as he had once been popular. Dubois died in August, 1723, soon after Louis XV. had been crowned; and the Duke of Orleans followed his evil genius to the grave in December of the same year. He was not yet fifty, but had already completely exhausted a vigorous constitution by his shameful life.

His son Louis (born 1703, and created Duke of Chartres at birth) succeeded to the title of Orleans, and at his death in 1752 another Louis (Louis Philippe, born 1725) followed him. This Louis Philippe, who received the title of Duke of Chartres during his father's life, served honourably in Flanders, and distinguished himself at the battle of Dettingen in 1743, the last battle ever led in person by a sovereign of England (George II.), became marshal of France in 1742, and lieutenant-general of the kingdom in 1744. He died in 1785.

LOUIS PHILIPPE JOSEPH is far better known by his revolutionary title, self-chosen, of *Egalité*. He was the son of the Dettingen duke last-named, and was born in 1747 at St. Cloud, taking the titles of Montpensier and Chartres. He early flung himself into opposition against the court: declaring himself loudly in favour of American independence, and personally opposing Louis XVI. when he sought to coerce the refractory *parlement* of Paris, for which he suffered a short imprisonment (1787). The quiet bourgeois morality of the court was not to his taste. He inherited vice, and did not disdain his inheritance: he lived a foul life. The richest man in France, already in 1783 "his hair is falling fast, and his blood is spoiled by debauchery: carbuncles stud his face, dark studs on a ground of burnished copper" (Carlyle, "French Revolution"). His vast new palace and inclosed new gardens, known to us as the Palais Royal, was notorious as the most profligate house in France. Louis and his queen, Marie Antoinette, perhaps showed their natural disgust too plainly; the duke

drifted further and further away from the court, and at last declared open enmity against the monarchy. He took great part in the States-general and the National Assembly, voting always with the extreme Left, becoming a member of the Jacobin Club, and even assisting the insurrections, when they soon afterwards began, with money and arms. He was, however, as much despised by the Jacobins as by the court, and as soon as he discovered this he veered round and made his peace with the good-natured king. But the open contempt of the better part of the court was too severe to be withstood, and the duke became frantically revolutionary. Hannah More ("Life," ii. 5) tells of seeing the duke, on a visit to England in 1789, slumped in Vauxhall Gardens as one pest-struck, but his red face showing no great signs that he cared for the dishonour. Nothing was too drastic for him. He renounced his name and title, calling himself Philippe Egalité thenceforth; and as a practical proof of the equality of all men he submitted himself for election, and was returned to the National Convention by the department of the Seine and Marne. In the Convention he continued the same course, but was never able to win the Republicans to believe in his loudly professed principles, not even when he came with his mistresses to the Convention to vote for the death of the king his cousin. In fact, as this horrible vote was given, "a groan and shudder ran through the hall of doom" (Carlyle). He went so far as to attend the king's execution in a cabriolet. All was in vain, and when his son, the young Duc de Chartres, who had been gallantly fighting under Dumouriez, followed his general's example and deserted the service of the bloodthirsty Convention, Egalité was at once arrested and sent to the Castle of If, out in the sea within sight of Marseilles (1793). On 3rd November of that year, after about six months' duress, he was brought up to Paris; and on the same day two famous women were thrown into the same prison, Dubarry, the mistress of Louis XV., and Josephine Beauharnais, afterwards empress. In three days his head fell on the scaffold. He died bravely, cool, and almost jaunty to the end; but the contempt of the mob was such that some miscreants who had to suffer with him refused to ride to death with him, and had to be flung bound into the cart. The people stopped the cart outside the Palais Royal, which had been painted with a large inscription "National Property." The young Duc de Chartres, now d'Orleans, was hiding at Chur in Switzerland, teaching mathematics for bread. He is better known by his title as king, **LOUIS PHILIPPE**.

The subsequent history of the House of Orleans is that in 1848 it was banished from France on the fall of the Orleans monarchy, and its property was confiscated by Napoleon III. in 1852. The Orleans usurpation had naturally caused a breach between the family and the elder Bourbons, but in 1853 a reconciliation was effected, and a more cordial meeting was brought about between the sons and grandsons of Louis Philippe and the Comte de Chambord shortly before the latter's death (1883). The princes of Orleans were allowed to return to France in 1871 by a vote of the National Assembly of the new republic, but were again expelled the country in 1886, by a law passed in that year, together with all the members of families which had reigned in France.

ORLEANS, NEW. See **NEW ORLEANS**.

ORMOLU is the name given to a gold-coloured brass or bronze, composed of seventy-five parts copper and twenty-five parts zinc. Its colour is enhanced by steeping it in dilute sulphuric acid for a time, after which it is brightened by means of a scratch-brush (a brush made of very fine brass wire). It is protected from tarnish by the application of lacquer. The principal use of ormolu is for castings of ornaments for furniture, candelabra, fenders, and other ornamental articles. The French more particularly excel in working in ormolu, and the product

of this branch of their industry hold an important position in the art manufactures of France.

OR'MOND, JAMES BUTLER, DUKE OF, the representative of an ancient and illustrious family, to whose annals he contributed some of the brightest pages, was born in London, 19th October, 1610. His father being drowned in 1619 he became Viscount Thurles, and having by a legal artifice been made a royal ward, he was placed by the king under the guardianship of Abbot, archbishop of Canterbury, with whom he stayed until 1626, and who successfully trained him as a Protestant. In 1629 he married his cousin Elizabeth, the daughter of the Earl of Desmond, some serious family differences being healed by this union, and in 1632, by the death of his grandfather, he became twelfth Earl of Ormond. Two years later his influence was secured for the king by Strafford, the lord deputy, whose efforts he supported with such ability that in 1640 he was made commander-in-chief of the forces in Ireland. He displayed great vigour and ability in the use of the means at his disposal, and frequently defeated the rebels in various engagements near Dublin, at Drogheda, at Kiltrush, and at Ross. From the Parliament he received thanks and a jewel worth £620, while the king created him Marquis of Ormond. In 1643 the Civil War in England having meanwhile broken out, he concluded a treaty with the Irish rebels, and sent all the succours he could command to the king in England. In November, 1643, he was invested by Charles with the nominal dignity of lord-lieutenant of Ireland, and he contrived to hold that kingdom for his master until 1647, when he resigned his authority into the hands of the parliamentary commissioners and joined the king, then a prisoner at Hampton Court. Finding he was about to be arrested by the Parliament, he retired to France and waited on the queen and Prince of Wales, to whom he was of great service. In September, 1648, he returned secretly to Ireland, and after the execution of Charles I. he caused Charles II. to be proclaimed king there. His efforts for the recovery of the kingdom proving ineffectual, he returned to Paris in 1650, and from this time until the death of Cromwell he was actively and variously employed in many important missions on behalf of the royal family. At the Restoration he was reinstated in his honours, created a peer of England as Baron Butler and Earl of Brecknock, and Duke of Ormond in Ireland. At the coronation he was lord high-steward, and in November, 1661, he was appointed lord-lieutenant of Ireland, a position he retained until February, 1668. From the Irish Parliament he received a gift of £30,000, but of the vast fortune which he had expended in the royal cause he recovered but a small portion, and his affairs remained in embarrassment to the end of his life. A man of lofty honour and integrity and of a pure life, he became a mark for the hostility of the licentious and corrupt favourites of the king, the profligate Duke of Buckingham being one of his bitterest enemies. By their efforts he was removed from his office as governor of Ireland, and in 1670, while driving through London, he was attacked and dragged out of his carriage by a band of ruffians who had been hired to murder him, and who were under the command of the notorious Colonel Blood. He was rescued out of their hands before they could carry their plans into effect; but nothing was done to punish the scoundrel Blood, and the son of Ormond openly charged Buckingham with complicity in the plot. James II. held Ormond in honour, and though the duke disapproved of much of the policy of the king, the latter, knowing his loyalty and honour, sustained him in his offices to the last. He died at Kingston Hall, Dorsetshire, 21st July, 1688, and was buried in Westminster Abbey on the 1st of August of the same year. The history of his life by Thomas Carte (three vols. folio, 1735), is an important contribution to the history of England.

ORMS' KIRK, a market-town of England, in Lancashire, situated 11 miles north-east of Liverpool, and 200 miles from London. It has a town-hall, grammar-school, almshouses, and other charities, and consists of four principal streets, which intersect each other at right angles. The church is mostly modern, with a few portions of Late Perpendicular character. Cotton and linen thread, silks, hats, and rope are manufactured here. In the vicinity are large collieries. The population of the town in 1881 was 8227. About 3 miles east is Latham House, once the seat of the Stanleys, earls of Derby, and celebrated for the siege which it sustained under the Countess of Derby in the civil wars of the seventeenth century; it is now the property of Lord Skelmersdale. A battle was fought near the town in 1614, between the royalists and parliamentarians, when the former were defeated with great loss.

ORMULUM, the famous ancient MS. English poem of the date of King John, so called from the name of its author Orm, or Ormin, is one of the greatest treasures of our early literature. It has preserved the language of the northern form of Old English in its transition period to the English of Chaucer; and in the anxiety of its author to make sure that his book should be properly read, knowing as he did that few could read save the priests, most of whom were Frenchified, if not themselves French (*i.e.* Norman-French), he invented some devices to indicate the pronunciation, for which his memory is revered by ardent philologists. One of these is doubling the consonant after a short vowel, thus:—

‘ This boe is nemmed *Ormulum*
Forthi that *Orm* itt wrohte.”

The poem had for its object to popularize and explain the (Roman Catholic) Latin Church services throughout the year; paraphrasing the gospel, the homily, &c., for every day, in metre of a swinging rhythm of eights and sevens. Orm was a canon of the order of St. Augustine, as he tells us, and entered upon his work at the request of his colleague, “brother Walter:” it is worthy of notice, perhaps, that both names, Orm and Walter, appear consecutively in the *Liber Vitæ* of the church of Durham. In the *Ormulum*, or what of it is left to us, are about 2300 words; and of these there are not sixty of foreign origin. Of these none are Norman (Orm evidently was a fervid Norman later), and only ten are Latin. His anxiety about his spelling is most evident; he abounds in injunctions on this head, and denunciations of the careless scribe who dares to neglect them.

“ And tatt he luke well thatt he
An boestaff write twiggess
Eggwhaer thaer itt upp this boe
Iss writen o thatt wise.”

(*Boestaff* is exactly the modern German *buchstabe*, letter; *twiggess* is of course “twice;” *eggwhaer* is the Scottish *quhair*, where, wherever.) It is also to be observed that *itt* has taken the place of the true Old English neuter, *hit*. Indeed the book is a perfect treasury of wealth to students of language. It is in Orm that we first find the word English (*Engliss*), and occasionally *Fingliss*; even Layamon, though so closely preceding him, has only an occasional *Englis*, and usually employs the old form *Englisc*. The best edition of the *Ormulum*, from the original MS. in the Bodleian Museum at Oxford, is that of the Rev. R. M. White, D.D. (two vols. Oxford, 1852), with copious notes and a glossary. This standard work on the subject was carefully re-edited for the Clarendon (University) Press, also in two vols., by R. M. Holt, M.A., in 1880.

ORMUZD (also written *Ahurmazd*, *Auramazda*, *Armuzd*, corrupted from *Ahura-Mazda*), “the Spiritual Being, Creator of all things”), was the name of the beneficent supreme divinity of the Persians, as represented in the creed of Zoroaster. According to the *Zendavesta*, Ormuzd, as the fountain of light and purity, created six

immortal spirits, then twenty-eight subordinate spirits, and, finally, the souls of men; while Ahriman, the source of evil and darkness, called into existence six evil angels, with divers subordinate demons. Hence results a never-ending war between these adverse beings, which will eventually issue in the triumph of Ormuzd, the subjugation of Ahriman, and the deliverance of mankind from the dominion of evil.

In this conflict man, according to the Zoroastrian doctrine, is called upon to bear his share, and to range himself under one or the other banner. He cannot serve both; he must acknowledge either light or darkness. “Choose one of these two spirits,” says the *Zendavesta*; “be good, not base.” See also **AHRIMAN** and **ZOROASTER**.

ORNAMENT. In every art, beyond the simple basis reposing upon eternal principles of form, there is scope for the fancy in the great realm of ornament, which clothes that basis with varied subsidiary forms of grace and beauty. In architecture, the mouldings and carvings—in pottery, the reliefs or intaglios, which are imposed upon the severe outlines beneath—in music, the outlying fringe or veil of notes thrown athwart the main melody—in painting, the careless sweep of drapery or tendril of vine, disguising yet completing the more definite contours—in oratory, the happy alliteration, the rich epithet, the pungent anecdote, overlaying the strict flow of the argument—in these and all other forms, and in these and all other arts, ornament is found to repose upon one or two plain principles, clearly distinguishing what is admissible from what is inadmissible, what is true from what is false.

The chief character of legitimate ornamentation is, appropriateness; that is, that it shall not conceal the lines or material of construction, and that it shall be fitted to its environment. The “cornices” of upholsterers, iron painted to imitate wood, and wood to imitate stone, paper-hangings passing for tiles, fireplaces of slate masquerading as marble, gas brackets which give themselves out as branches of flowers, and so forth; inkstands which pretend to be beetles, thermometers which disguise themselves as pyramids, pencils which assert themselves as pistols, and the like, meet the eye in most of our living-rooms, and are excellent specimens of radically false ornament. The added forms indulged in by ladies, now on the head, now on other parts of the figure, do not beautify; they destroy the naturally lovely outline of the female form, by destroying its constructive reason. So with absurdly thin waists, small feet, &c., which, by plainly rendering their owner useless for the main functions of a human being, are, and remain for ever, ugly to any eyes not blinded by fashion. It is not unfrequent to see a human figure artificially made into such a shape that if the owner really possessed the flesh and blood outwardly claimed, it would be impossible to move without at once falling, overbalanced, to the ground.

The heavy forms of Egypt, the simplicity of the classic style, the soaring romantic Gothic are illustrations of fine adaptation to the special environment in the art of architecture. Each of these styles becomes comparatively meaningless if transplanted to the climate of the other. The architecture of the Greeks is exquisitely ornamented; every part has its reason and its justification. It is only moderns who decorate a column by horizontal bands (as they decorate a dress by flounces); Greek ornament in such a place was rigidly vertical. A perusal of the article on **GREEK ARCHITECTURE** will render apparent the wonderful skill of the ancients in this particular. It is needless to follow out the illustration in all the other arts: but perhaps, as a very different type, it may be permitted to refer to musical ornament. Here, as in the closely allied oratorical ornament, the additions, besides being in themselves graceful and appropriate, must be kept rigidly subordinate to the main purpose, must help it forward in some way, must never overload it so that the style becomes

laboured or diffuse or turgid, and must never obscure the constructive lines of form, nor turn aside the definite current of thought which they for the moment pleasingly delay.

The second great principle of ornament is that it should not be slavishly imitative of natural objects. A finished picture used as an ornament, as when elegant bouquets are used in wall papers as their pattern, or heads and flowers are elaborately sculptured for finials, &c., are quite inappropriate. Proper decorative ornament in the graphic arts—to take one example in detail—requires a generalized, almost geometrical form of the selected object, not its perspective or accurately modelled portrait. The snails and lizards of Palissy ware, besides sinning against the canon of appropriateness (for who desires to find a snail crawling on his dessert plate?) sin also against this of the avoidance of portraiture. The nearer they get to nature the more tasteless do they appear. (The use of paintings as wall-decorations, or of sculpture as architectural features, does not of course really infringe this rule, as a moment's thought will show.) Like the first, this second principle applies equally to all the fine arts alike; and the reader may fully exercise his ingenuity in following it out in each. To sum up, therefore, ornament must always have constructive meaning, must be subordinate to the general construction, and should be openly ornamental and decorative, not imitative and deceptive.

A certain balancing of ornament is usually necessary, but not indispensable. A pattern of any kind gains by repetition, but it would be unfair to class a single pattern as an inferior ornament. Nor need the balanced parts be absolutely symmetrical; as witness the handle and lip of an elegant vase, which quite satisfy the feeling for ornament when nicely proportioned. On the other hand, a pattern poor in itself often becomes beautiful by repetition: dancing with its simple rhythms, almost meaningless if performed but once, is an excellent example of this power of repetition to enhance the meaning and value of ornament. We must regard dancing as ornamented walking or running.

ORNE, a department in France formed out of the old duchy of Alençon, the northern part of Perche, and a portion of the south of Normandy, is bounded N. by the department of Calvados, E. by those of Eure and Eure-et-Loir, S. by those of Sarthe and Mayenne, and W. by that of Manche. Its greatest length from east to west is 87 miles; the average width is 28 miles. The area is 2635 square miles, and the population in 1882 was 376,126.

Surface and Hydrography.—The department is traversed from east to west by a range of wooded hills which forms part of the watershed between the English Channel and the Loire. The highest points in this chain do not exceed 1368 feet. The larger portion of the department lies to the north of this range, from which numerous lateral chains spring off in a general north or north-western direction, inclosing between them fertile and well-watered valleys. A considerable part of the surface, however, is sandy and sterile. A small portion of the department, drained by the Itou and the Rille [see **EURE**], slopes towards the north-east. The other more important rivers to the north of the principal range are—the Touque, the Dive [see **CALVADOS**], the Aure [see **EURE**], and the Orne, which gives name to the department. The Orne rises near Sées, and runs through the department past Argentan in a north-western direction, till it enters Calvados, where it turns north by east, passing Caen; here it becomes navigable, and enters the English Channel about 10 miles below this town, after a course of about 70 miles. Its principal feeders are the Noireau, the Aize, and the Odon. That portion of the department which belongs to the basin of the Loire is drained by the Mayenne and the Sarthe; this last-named river rises near Sées, and runs for some way along the southern boundary. There are a great number of ponds and several mineral springs, of which that at Bagnoles, 12½ miles

distant from Domfront, is famous for the cure of skin diseases and of rheumatism.

Climate, Soil, &c.—The climate is in general temperate, not damp. The spring brings cold east winds, white frosts, and rain; the summer is dry and warm, but terminates with storms in September; in autumn the rains begin to all about the middle of October, then succeed white frosts till the end of November; in the depth of winter there are continual fogs with much rain and snow. The chief grain crops are wheat, mixed corn, rye, and oats, of which in ordinary years the produce suffices only for about two-thirds of the consumption. No wine is produced; cider is the chief beverage. The number of apple and pear trees, which are planted along the roads, round the fields, or in quincunxes, amounts to several millions. The pasture-land of the department is of considerable breadth, and in general of good quality; great numbers of lean cattle, purchased in the neighbouring departments, are fattened for the Paris and the Rouen markets; good butter and medium cheese are made. The plain of Alençon is famous for its saddle horses of the purest Norman breed; in the rest of the department a large number of cart horses, also of the Norman breed, are reared. Poultry of all kinds, especially geese, are abundant, and eggs form an important article of commerce. Wolves and foxes are common, but there are only a few wild boars and stags.

Industrial Resources and Products.—Several iron mines are worked: and marble, granite, porphyry, building stone, marl, kaolin, porcelain clay, black-lead, and quartz crystals are found; the latter, after being carefully cut, have the name of Alençon diamonds.

Besides pig and bar iron, the industrial products include sheet iron and copper, wire of different kinds, pins and needles, linen, canvas, lace, thread, hair cloth, cotton and woollen yarn, glass, paper, beet-root sugar, pottery, and leather. There are several large bleach-works in the department. Other articles of commerce are—corn, clover-seed, cider, perry, flax, thread, linen, wax, honey, horses, fat cattle, pigs, poultry, goose feathers, oak staves, timber, and firewood.

The department is divided into the four arrondissements, Alençon, Argentan, Domfront, and Mortagne. The capital is **ALENÇON**.

ORNITHOGALUM, a genus of plants belonging to the order **LILIACEÆ**. The flowers are white or yellow, never blue. *Ornithogalum umbellatum* (common star of Bethlehem) is found in meadows and pastures in Great Britain. It is common in Palestine, where its bulbs are cooked and considered nutritious. Some botanists identify this plant with the "dove's dung" of the Bible (2 Kings, vi.) *Ornithogalum pyrenaicum* (spiked star of Bethlehem) has flowers of a greenish-white. The leaves wither before the stalk appears; they are rarely contemporaneous. It is found in Sussex and Bedfordshire, and is so common near Bath that the young shoots are sold in the spring as a substitute for asparagus. *Ornithogalum nutans* is occasionally found in fields and orchards in Great Britain.

ORNITHOLOG'Y. See **BIRDS**.

ORNITHOPUS (Bird's Foot) is a genus of small annual plants, found in pastures and wild places in Europe, and belonging to the order **LEGUMINOSÆ**. The species (*Ornithopus perpusillus*) found in this country is a plant from 2 to 6 inches high; but in Portugal occurs the *Ornithopus sativus*, an annual growing as much as 2 or 3 feet high, with stems as succulent and nutritious as those of vetches or lucerne, and cultivated in that country as food for cattle. The name is derived from the Greek, and means "bird's foot," as the jointed curved pods have some resemblance to the claws of a bird.

ORNI THORHYNCE'US. See **DUCKBILL**.

ORNI THOSCEL'IDA. See **DINOSAURIA**.

OR'NUS. See **ASH**.

OROBANCHACEÆ is an order of plants belonging to the GAMOPETALÆ, cohort Personales. The species are herbaceous, growing parasitically upon the roots of other plants, and, as is very usual in such cases, producing no true leaves, but furnished with brown or reddish scales in their place. The corolla is irregular; there are only four stamens, the fifth being aborted; the ovary is one-celled, with parietal placentas; the fruit is a two-valved capsule, with numerous minute albuminous seeds. Their properties in general are astringency and bitterness, and many of the species have been used as tonics, as well as for application to indolent ulcers. In this country the order is represented by the genus *Orobanchæ* itself, the various species of which, called Broom-rape, are found in fields, upon the roots of broom, furze, hemp, clover, bed-straw, &c.

OROBANCHÆ, a genus of plants, the type of the order OROBANCHACEÆ. *Orobanchæ major* (greater broom-rape) is a native of Europe, growing parasitic upon broom, furze, and other shrubby leguminous plants, on a barren and dry soil. It is abundant in some parts of Great Britain. This plant is very bitter and is a powerful astringent. *Orobanchæ minor* (lesser broom-rape) is found in Europe parasitically upon the roots of clover. It is sometimes very abundant, and is found in many parts of England.

ORPHEUS, a poet, musician, and philosopher, whose name is prominent in the early legends of Greece. According to the legend, he was a son of the Thracian river Oëgros and the muse Kalliope. He was one of the Argonauts, to whom he rendered great services by his musical skill. It was the force of his music which drew the great ship to the sea, no human power sufficing to launch her; many times he drew his comrades out of danger and temptation by the witchery of his music, and even the magic rocks which moved to crush the ship between them paused while he sung, and let their prey escape. His wife was Eurudikê (Lat. *Eurydice*), who died from the bite of a serpent. Orpheus descended into Hades, and by the spell of his music enthralled the fierce guardians of the nether world. His wife was restored to him, on condition that he neither touched her nor looked at her till they reached the upper air. As Orpheus passed the threshold, his wife gliding noiselessly close behind him, he could not resist a glance over his shoulder to make sure she had followed. It was enough. He saw her snatched back by relentless hands, and knew that she was for ever lost to him. According to one account, Orpheus himself was torn in pieces by the women of Thrace for his excessive sorrow for the death of his wife and his contempt for the charms of all other women. The chief legends concerning Orpheus are those which relate to his musical skill, by which he tamed wild beasts and caused even inanimate things to move. They are probably of a solar character; and the name Orpheus is believed by Professor Max Müller to be connected with the Sanskrit *Arbhu*, an epithet of Indra or the sun. (Thus, *Arudikê* may be *Ūru*, Sanskrit for dawn or twilight; but by the serpent night, restored to Orpheus or *Arbhu*, the sun, only to be slain by his beams as the dawn dies out before the day.)

The poets and fabulists attribute to Orpheus many improvements in the condition of the human race. He is said to have founded the religion of Greece and the mysteries.

ORPHIC MYSTERIES, a religion ascribed to Orpheus. The Dionysos, to whose worship these Orphic and Bacchic rites were annexed, was the Chthonian deity Dionysos Zagreus, closely connected with Dêmeter and Korn, who was the personified expression, not only of the most rapturous pleasure, but also of a deep sorrow for the miseries of human life. The Orphic legends and poems related in great part to this Dionysos, who was combined, as an infernal deity, with Hadês (a doctrine given by the philosopher Herakleitos as the opinion of a

particular sect), and upon whom the Orphic theologians founded their hopes of the purification and ultimate immortality of the soul. But their mode of celebrating this worship was very different from the popular rites of Bacchus. The Orphic worshippers did not indulge in unrestrained pleasure and frantic enthusiasm, but rather aimed at an ascetic purity of life and manners. The followers of Orpheus, when they had tasted the mystic sacrificial feast of raw flesh torn from the ox of Dionysos, partook of no other animal food. They wore white linen garments, like Oriental and Egyptian priests, from whom, as Herodotus remarks, much may have been borrowed in the ritual of the Orphic worship. The most intelligible account of this obscure subject is Lobbeck's "*Aglaophamus*" (Leipzig, 1829). The extant poems called *Orphika* are spurious poems of much later date; the genuine mystic verses were already felt to have been tampered with in the time of Peisistratos, when OSOMAKRITOS was set to collect them, as is elsewhere described. The best edition of these Orphic fragments, such as they are, is that of Hermann (Leipzig, 1805).

ORPIMENT, a term corrupted from *auri-pigment*. It is the name given to a native sulphide of arsenic which appears in crystalline lumps of a fine golden-yellow colour. It is used as a pigment by artists, the finest samples coming from Persia, and also as a yellow dye for silk, woollen, or cotton goods. It also forms an ingredient in fireworks and in some depilatories, and in former times it was employed in medicine. Artificial orpiment or king's yellow is prepared by sublimation from a mixture of arsenious acid and sulphur. It also falls as a precipitate when a stream of sulphuretted hydrogen gas is passed through an acid solution of arsenious acid or of an arsenite. King's yellow was formerly in considerable use as a pigment, but it has been largely superseded by chrome yellow.

ORRERY. This name has been applied to four different kinds of machines for representing the phenomena of the solar system. A planetarium exhibits the actual motion of the planets about the sun; the tellurian and lunarian machines exhibit respectively the motion of the earth about the sun and of the moon about the earth; and a satellite machine the motion of Jupiter's satellites about their primary.

Planetary machines were in use at a very remote period, and appear to have consisted for many centuries of movable skeleton spheres having the earth in their centre. Thus we read of Chinese spheres 2000 years B.C., and of the spheres of Archimedes, Posidonios, and other ancient Greek philosophers.

In the latter part of the seventeenth century Huyghens and Roemer employed themselves in the construction of planetary machines in conformity with the Copernican doctrine. In England, about the year 1700, Mr. George Graham constructed a machine which exhibited the motion of the earth about the sun while the moon revolved about the earth. One of these machines was made by Rowley, copying Graham's construction, for the Earl of Orrery, in which circumstance the term orrery originated. A large planetarium was, in 1801, made for the Royal Institution of London, and a more complete instrument constructed by Dr. Pearson in 1813.

To produce the revolution of the planetary balls about the sun, a system of vertical concentric tubes is usually employed. The tubes are of different lengths, the innermost being the longest, and to the superior extremity of each a radius vector is attached, and thereby made to revolve once during each revolution of the tube. The lower extremities of the tubes form the arbors or axes of as many toothed wheels, which are either immediately driven by pinions adjusted to a vertical axle called the annual arbor, or derive their motions indirectly from those pinions by means of an interposed train of wheels. The

determination of the relative number of teeth which must be given to the wheels and pinions in order to produce the required motion may be thus explained:—

Supposing we wish the radius which carries the ball representing the earth to revolve once during each revolution of the annual arbor, it is only necessary that the wheel which is adjusted to the lower extremity of the earth's tube should contain the same number of teeth as the pinion by which it is driven, and which is adjusted to the annual arbor. In this case each revolution of the annual arbor will be the measure of one solar year. If now the rate of Jupiter's revolution is to be shown, this depends upon the ratio between the rates of the earth and of Jupiter. A near approximation to this fraction is expressed by $\frac{7}{8}$; therefore, if the wheel attached to Jupiter's tube contain eighty-three teeth, and the pinion attached to the annual arbor by which it is driven contain seven teeth, then Jupiter's radius will revolve once during 11 $\frac{2}{7}$ revolutions of the annual arbor. This number, being multiplied by 365.2564 days, gives 4330.897 days for the time in which Jupiter's revolution is performed; and this is less than the true period by 1.688 day only. Similar calculations govern the rest of the planets which are represented in the orrery.

The contrivance by means of which a true elliptical orbit may be produced is extremely simple. For this purpose all that is necessary is that the radius vector which connects the planetary ball with the superior extremity of the tube should consist of two parts or arms, the lengths of which have a determinate ratio dependent solely upon the eccentricity of the orbit, and that while the larger arm revolves about the *centre* of the ellipse by means of the wheel-work already described, the smaller arm be made to revolve about the extremity of the larger with the same angular velocity, but in the opposite direction. In the orrery in Plate I., S represents the sun; *a*, the brass meridian on which the degrees of latitude are marked; *b*, the equinoctial line. The signs of the zodiac are painted on the twelve sides of the framework of the orrery.

Notwithstanding the ingenuity displayed in these contrivances, it must be observed that the most complete mechanical representation of the solar system that has yet been invented, though useful to children or to persons hitherto quite ignorant of astronomy, is far inferior to that which a student may form in his own mind from an attentive perusal of a good popular treatise on the subject; and Sir John Herschel, undoubtedly a competent authority on such a subject, pronounced the orrery a very childish toy.

The simpler kind of orrery, known as a *planetarium*, is shown on an enlarged scale in Plate II. Here we see the planetary system exhibited after the condensed fashion of a vigorous rough diagram. To the earth and the moon is applied a special frame, *c* *d*, with four wheels and two pinions, so that the earth's axis is preserved at its due inclination throughout its revolution round the sun, and at the same time the moon is properly moved with relation to the earth. But as to the other satellites, as those of Jupiter, of Saturn, &c., they are usually left to be moved by the hand as required. Uranus is generally omitted, from considerations of space. The whole planetarium is set in motion by the wheel *u*, the wheelwork being contained in the large table. The arm, *m*, that carries round the moon, points out on the plate *c* her age and phases for any situation in her orbit, the latter being represented by the flat rim *n*, which may be made to incline to any desired angle; *n* represents of course the ecliptic. The machine shows the seasons, the interchange of day and night, &c., very clearly, and the more especially if a suitable lamp, as at *l*, with a movable lens properly adjusted, be inserted in the place of the sun. Eclipses are very fairly shown also in this manner. On the other hand, if the earth and sun be made to change

places, the manifest absurdities of the Ptolemaic system become self-evident; all the planets turn one way (instead of frequently having periods of retrograde motion, as we know they have), Mercury and Venus are never seen to pass behind the sun (whereas we know by observation that they pass behind as often as they pass before), and it is also manifest that if the planets revolve round a central earth they must always be the same distance from it, and therefore appear of the same size, whereas any one who observes can see Mercury sometimes rivaling Jupiter in glory, and at other times faintly twinkling like an ordinary star. These and other contradictions of the Ptolemaic theory of a central earth are excellently exposed.

Another machine whose construction reposes on similar principles is the *eclipsareon*, for showing the main phenomena of solar eclipses, of which a figure is engraved in Plate I. illustrating this article. Here *A* is the earth, which is turned by a wheel *m* on its axis *b*, inclined as in nature 23 $\frac{1}{2}$ degrees, and carrying an index round the hour circle *v*; a circular plate, *e*, on which the months and days of the year are inscribed, supports the globe in such a way that when the given day of the month is turned to the annual index, *g*, the axis has the same position with the earth's axis at that time; *r* is a bent wire which is directed at the earth's centre, and serves to show where the sun is vertical above the earth at the given time; the thin brass circular plate *i* is divided by twelve concentric circles into digits, and is of such a size as to represent a section of the moon's penumbra, so that when light is thrown from a suitable distance behind it upon the earth, through a convex lens (to give parallel rays), its shadow may fall on the mimic earth with a size relatively the same as the shadow of the moon upon the real earth; it is suspended in the frame *h* *h*, and can be made to travel across it from side to side by the turning of the wheels *l* *l*, carrying a cord fastened to it as at *k*, or to travel up and down by adjusting the sliders *k* *k*; *h* is marked with a scale of the moon's latitude; *c* is a solar horizon, showing the division of night from day.

Now, if *k* *k* are set to the moon's latitude, and *e* is turned till the day of the given new moon is opposite *c*, and the penumbra adjusted so that the vertical thread across the frame passes through its centre, this thread representing the axis of the ecliptic; and if the handle, *m*, be turned till the meridian of London come under the wire *r*, and the index in hour circle, *v*, be set at the time of the new moon, the machine is ready to work. The light and *k* as are suitably adjusted, the shadow of the vertical thread falling in the meridian of London. The collar, *x*, is screwed fast, which brings the wheels, *l* *l*, *i*, into connection with *m*, so that as the globe rotates so also does the penumbra move from side to side, and the wheels are so proportioned that the movement of the penumbra bears the proper natural relation to the movement of the earth's rotation. The penumbra is brought to the right side of the frame by turning *m* backwards, and then as it moves from right to left, the earth turning at the same time, all the phenomena of the eclipse are made thoroughly apparent. An inspection of the machine as it works makes it manifest where the eclipse is visible and where it is invisible; its character as partial, total, or annular; its time and duration are also clearly shown. Unlike the orrery, the *eclipsareon* is a really philosophical and accurate machine. It is due to the invention of the astronomer Ferguson, and is figured in Sir D. Brewster's edition of his works.

ORRIS-ROOT is the creeping underground stem (rhizome) of species of *IRIS*, namely, *Iris florintina*, *Iris germanica*, and *Iris pallida*. Every year a new joint of the rhizome is produced 3 or 4 inches in length. When fresh, there is only an earthy smell from the root, but after a period of two years it acquires, probably by slow fermentation, a delicate odour of violets. Even in the time

of the Greeks orris-root was used as a perfume. At the present day it is much used in dentifrices.

ORSOVA, OLD and NEW, two important points, the former a fortress in Hungary, on the left bank of the Danube, 90 miles south-east of Temesvár, the latter (Adakaleh or New Orsova) a fort belonging to Serbia, formerly a Turkish stronghold, on an island a little west. Four miles below it is a rocky gorge of the river, called the Iron Gate, between the offsets of the Carpathians and the Servian Mountains, rising 600 feet on each side. The water has a rapid current, and there are strong eddies among the rocks. Here a road was cut by Trajan through the rock, which forms the principal one from Vienna to Constantinople. The inscription still exists. Goods and passengers were formerly disembarked here to avoid the rapids, but the plateau of rock over which the river formerly rushed has now been so far removed by blasting that steamers drawing not more than 4 feet of water can always pass.

ORTHEZ, a town in the French department of Basses-Pyrénées, 25 miles north-west from Pau, and 37 east from Bayonne, is pleasantly situated on the right bank of the Gave-de-Pau. The population was 6556 in 1882. The streets of the town are well laid out, and the houses well built. There are, on a height commanding the town, some ruins of the ancient castle of Moncade, in which Gaston Phœbus, count of Foix, lived and died. Orthez has manufactures of woollen stuffs, linen, yarn, leather, luscied oil, &c. There are also dychouses, copper foundries, and saw mills. The commerce in hides, hams, wool, goose feathers, flax, timber, slates, cattle, and marble is considerable. The French under Marshal Soult were defeated, after an obstinate battle, by the allied army, commanded by the Duke of Wellington, near this town, 27th February, 1814. One of its governors, a Viscount d'Orthez, is famous for being one of the few who refused to carry into effect the orders of the court for the massacre of St. Bartholomew.

ORTHOCLASE (Gr. *orthos*, straight; *klaô*, to cleave) is commonly known as potash felspar, and receives its mineralogical name from its rectangular cleavage. It is a silicate of alumina and potash, and forms an essential constituent of granite, gneiss, mica-schist, and many other rocks. Fine crystals are often met with in the granites of Devonshire and Cornwall, and it is the decomposition of this mineral that produces KAOLIN or China clay. *Adular* is a very pure variety of orthoclase, and receives the name of *moonstone*, when a peculiar bluish glimmer is observed on cut surfaces. *Amazon stone* is another variety, remarkable for its green colour; and a tabular, glassy form is termed *SANTHINE*. See also FELSPAR.

ORTHO'EPY and ORTHOGRAPHY are related grammatical terms. The first (Gr. *orthos* and *epos*, a right word) properly signifies the correct use of words to express a certain meaning, but is now generally applied to that part of prosody which treats of the right pronunciation of words. On the other hand, orthography (Gr. *orthos* and *graphô*) relates to the method of describing sounds by arbitrary visible signs, to the different kinds of letters, and their combination into syllables and words, and hence includes correct spelling.

ORTHOG'ONAL and ORTHOGRAPHIC, mathematical terms, the first of which, when not used in the same sense as the second, means simply perpendicular. Thus a curve cuts a set of curves orthogonally when it cuts them all at right angles. Orthographic (or orthogonal) projection is that which is made by drawing lines from every point to be projected perpendicular to a plane of projection. Thus, if a plane were horizontal, and a point were to drop from a given position upon the plane, its last position would be the orthogonal or orthographic projection of its first.

ORTHOPTERA is an order of insects distinguished by having a mandibulate mouth, the fore wings leathery, and serving to protect the broad net-veined hinder pair,

which are folded longitudinally, and the hind legs usually large and adapted for leaping. The metamorphosis is incomplete, the larva and pupa being active and closely resembling the perfect insect, except in the presence of wings. Wings, indeed, even in the perfect insects, are frequently absent, especially in the females. The eyes are usually large, and in addition two or three ocelli or simple eyes are sometimes present. The anal extremity of the body is provided, in the females of many species, with an ovipositor, and in both sexes with other appendages. Organs of hearing occur among the locusts, grasshoppers, and crickets, which insects also possess the power of stridulation. The alimentary canal is well developed. The Orthoptera are at present the oldest known insects. In December, 1884, at Calvados in France, in Middle Silurian strata, there was discovered the wing of an insect closely resembling the existing genus *Blatta* (cockroach); and in Carboniferous formations there have been found remains of insects which appear to unite this order with the Neuroptera. This order includes some of the largest of insects, such as grasshoppers and Mantidæ. Except the Mantidæ, which are carnivorous, and the omnivorous Blattidæ, all the members of this order are vegetable feeders.

With the order Orthoptera are frequently combined the Neuroptera with incomplete metamorphoses, under the name Pseudo-Neuroptera; these are, however, undoubtedly the typical Neuroptera of Linnaeus, and have been treated in this work under that name.

The order Orthoptera may be divided into four suborders, *Cursoria*, *Gressoria*, *Saltatoria*, and *Emplexoptera*. The suborder *Cursoria* is composed of the Blattidæ or cockroaches (Plate, fig. 1), insects frequently apterous, with flattened bodies, small heads, and five-jointed tarsi. The *Gressoria* comprise the Mantidæ (fig. 2) and Phasmidæ, and are distinguished by the long narrow body, exerted head, slender legs, and five-jointed tarsi, and the frequent absence of the wings. The Mantidæ are predaceous and carnivorous, while the Phasmidæ are vegetable-feeders; in addition, the prothorax is very long in the former, very short in the latter family. The Phasmidæ are remarkable for the extraordinary resemblance which some of their species present to leaves and twigs. The *Saltatoria* are chiefly distinguished by having the hind legs adapted for leaping, the hind femora being thickened. This suborder contains three families, *Gryllidæ*, *Locustidæ*, and *Acrididæ*. The *Gryllidæ* (figs. 4-6) or crickets have long bristle-like antennæ and three-jointed tarsi; the fore wings lie horizontally over the hind pair; the fore legs are sometimes adapted for digging, as in the mole-cricket (*Gryllotalpa*, fig. 6). The *Locustidæ* contain some of the insects known as grasshoppers, but not the true locusts, which fall under the following family. They are distinguished by the position of the fore wings in repose, which are placed almost perpendicularly on the sides of the body; the tarsi have four joints, and the antennæ are long and bristle-like. The *Acrididæ* (fig. 7-9) contain the locusts and the common grasshoppers. They are distinguished chiefly by their short, stout antennæ and three-jointed tarsi. The suborder *Emplexoptera* contains the *Forficulidæ* (fig. 3) or earwigs. In this family the fore wings are very short and leathery, and conceal the large hind wings, which are folded both transversely and longitudinally; some species have no wings. The anal segment is provided with a movable forceps.

ORTLER-SPITZ, a magnificent snowy peak of the Ortler Alps, which extend across the frontier of Tyrol and Lombardy, between the valleys of the Upper Adige, Oglio, and Adda. Its height is 12,817 feet, being the loftiest summit in the Austrian Empire. Snow limit, 8500 feet.

ORTOLAN (*Emberiza hortulana*) is a species of Finch or BUNTING, much esteemed by epicures for the delicacy of its flesh when in season. The south of Europe

may be considered the summer and autumnal headquarters of the ortolan, though it is a summer visitor in the central and northern parts. Lapland, Russia, Denmark, Sweden, and Norway are among the countries visited by it. In England it seems to be only entitled to rank as an accidental visitor, but it is by no means clear that it does not occur more frequently than is generally supposed; for, especially to an unpractised eye, it might be mistaken for the yellow-hammer, and in some states of its plumage for other buntings. It is also known in Western Asia. The ortolans are taken in great numbers in nets, kept in a dark room, and fed with an abundance of oats and millet, upon which diet they soon become excessively fat. This bird is



Ortolan (*Fulcoriza hortulana*).

about 6 inches in length, and of a deep reddish-brown colour above, with the head greenish gray; the lower surface is reddish-buff, with the throat and breast yellowish-green.

OR'US or **HOR'US**, an Egyptian deity, the son of Isis and Osiris, corresponds somewhat to the Apollo of the Greeks, and being the last of the gods who by tradition reigned in Egypt, was as such progenitor of the Pharaohs. In Egyptian paintings he is often represented as sitting on the legs of Isis. He is a hawk-headed god.

ORVIE' TO (anciently *Urbibentum*), a city of Perugia, Central Italy, at the junction of the Paglia and Chiana, affluents of the Tiber, 60 miles N.N.W. of Rome, with which it is connected by railway. It is chiefly remarkable for its handsome Gothic cathedral, begun about the end of the thirteenth, and finished towards the middle of the fourteenth century. The façade, one of the finest in Italy, is ornamented with sculptures and mosaics. The interior contains a very large collection of the sculptures of the sixteenth century, and is enriched by many beautiful paintings and other works of art. The other remarkable buildings in the town are several palaces, archbishop's and papal residences, some Etruscan remains, the Jesuits' College, and St. Patrick's Well (Pozzo di San Patrizio), excavated in the tufa rock on which the place is built. The country around Orvieto is fertile, and produces a delicate white wine, in great repute at Rome. The population in 1882 was 15,931.

O'RYX is a genus of ANTELOPE inhabiting Africa and Arabia. The oryxes are distinguished by the possession in both sexes of horns, which are long, straight, or slightly recurved, and more or less ringed. The body is of moderate size, and the tail lengthy and tufted at the tip. The best known is the Leucoryx (*Oryx leucoryx*), which is probably the oryx of the ancients, though others give that name to the closely-allied Gems-nok. The leucoryx is a native of Senegal and Nubia. The fur has a milky-white colour generally, the throat and neck being rufous-brown; dark bands also occur on the forehead and cheeks, two of them passing vertically downwards from the inner corner of the eye. The mane is short and reversed, the tail

being lengthy and tufted at the tip. The horns are very attenuated, annulated at the lower half, and slope obliquely backwards with a very slight curvature. The leucoryx is gregarious in its habits, and feeds freely on acacia shrubs.



Leucoryx.

Very similar are the Beisa Antelope (*Oryx beisa*) from Abyssinia, and the Beatrix Antelope (*Oryx beatrix*) from Arabia, the latter being distinguished by its dark legs and white feet.

OSA'KA or **OHOSA'KA**, a large city of Japan, on the south-west coast of Nippon, 20 miles south-west of Miako or Kioto, at the mouth of the Yedogawa, which flows from Lake Biwa. It is the greatest emporium of commerce in Japan, and one of its five imperial cities, and is situated in a fruitful plain. The greater part of its trade passes through Hiogo in the first instance. The streets are narrow, but regularly laid out at right angles. The buildings are not imposing, with the exception of the temples, many of which are splendid specimens of art, rich in gold and lacquer work. Upwards of 100 bridges cross the river and canals, many of them of beautiful design. Around the city lie wide tea districts, the most populous in Japan. A railway, uniting Osaka with Hiogo its port, was opened in 1873, and it is in telegraphic communication with Tokio and Nagasaki.

O'SAR, the Swedish name for ESKERS or KAMES.

OS'BORNE and **ST. HELEN'S BEDS**, a series of fresh-water and brackish-water strata, about 100 feet in thickness, belonging to the uppermost Eocene formation of the Isle of Wight. These beds occur between the Heanton series and the overlying Bembridge Limestone, and were so named by Professor Edward Forbes in 1853. In the most complete sections two divisions are distinguishable—the St. Helen's sands above, and the Nettlestone grits beneath—and the lower division furnishes a valuable building stone. Among the chief fossils may be mentioned, the molluscs *Cyrena obovata*, *Linnæa longiscata*, *Melania costata*, *Paludina lenta*, *Planorbis encephalus*, and the terrestrial *Helix ocellata*; there are also numerous Entomostraca, and the remains of fresh-water plants of the genus *Chara*. The fructifications of the latter are known as "gyrogonites."

OS'CI or **OP'ICI**, a people of ancient Italy who inhabited the southern part of the peninsula, and covered the country from the Tiber to the Straits of Sicily. The names Opicus and Oscan are undoubtedly the same. The southern extremity of the peninsula appears to have been occupied previously by the Enotrians, a Pelasgic people

who were conquered by the Lucanians and Brutii. Cumæ, one of the earliest Greek colonies on the coast of Italy, was in the country of the Opici.

The Oscan language (called by the natives *Uscas*) was the parent of the dialects of the native tribes from the Tiber to the extremity of the peninsula, Sabini, Hernici, Marsi, Samnites, Sidicini, Lucanians, and Brutii, whilst in the regions north of the Tiber the kindred Umbrian and the altogether strange Etruscan predominated. Livy mentions the Oscan as being the language of the Samnites. The older Latin writers, and especially Ennius, have many Oscan words and Oscan terminations. The Oscan language continued to be understood at Rome down to a late period under the empire. The farces called *Fabule Atellanæ* were always in Oscan. In the Social War the confederates, who were chiefly people of Oscan descent, stamped Oscan legends on their coins. In Campanian and Samnium the Oscan continued to be the vulgar tongue long after the Roman conquest, as appears from several monuments, and especially from the Oscan inscriptions found at Pompeii. The Umbro-Oscan language was closely akin to Latin—that is, much nearer to it than Greek, for example—but had decided differences. The dialect of modern Naples, derived from Oscan, is unintelligible to the pure Tuscan, whose Italian was derived from Latin. Probably in ancient times the differences were not so insurmountable. As a specimen, the Oscan infinitive ended in *-am* (cf. Greek *-ειν*), and the genitive of nouns in *a was*, like the Greek; *p* was used for Latin *qu*, as *pod* for *quod*, &c.

OSCILLATION and CENTRE OF OSCILLATION (Lat. *oscillum*, a swing). The former signifies, in general, a movement of a body or system alternately on opposite sides of the position occupied when in a state of rest. When any system is slightly disturbed from its position of equilibrium, it either falls altogether, or endeavours to recover the position which it lost. In the latter case the equilibrium is said to be stable, and in the former unstable. A pendulum hanging downwards is an instance of the stable kind, and the same pendulum, if it could be so nicely adjusted as to rest immediately over the pivot, would be of the unstable kind. The problem of oscillations usually refers to certain small deviations of a material body acted on by gravity, when it moves upon a horizontal axis; for example, to the laws of vibration in pendulums.

The *centre of oscillation* of a pendulum is that point which, if all the weight of the pendulum were concentrated upon it, and the connection with the point of suspension remained rigid, would oscillate at precisely the same rate as the entire pendulum. In considerations affecting the length of the pendulum, it is manifestly not the apparent length but the distance of the centre of oscillation from the centre of suspension which has to be measured and taken into account. It is perhaps as well to add (1) that the centre of oscillation by no means corresponds to the centre of gravity; and (2) that the centres of oscillation and suspension are mutually convertible; that is, if a pendulum be suspended from the former it will oscillate at precisely the same rate as when suspended, as usual, from the latter.

OSIRIS, the principal ancient Egyptian deity, was the consort and brother of Isis and the father of Orus, and is said by many writers to have been the first king of Egypt. His history is given in the first book of Diodorus, and in the treatise of Plutarch, "On Isis and Osiris;" but it is not improbable that the genuine Egyptian traditions respecting this deity had been considerably corrupted at the time of these writers. According to their accounts, Osiris was the first who reclaimed the Egyptians from a state of barbarism, and taught them agriculture and the various arts and sciences. Osiris then travelled into foreign lands spreading the like blessings. On his return his brother Seb or Set, whom the Greeks called Typhô, and who was the impersonation of evil, as Osiris of good, slew him by

hermetically sealing him in a splendidly carved chest, into which he had been treacherously induced to enter by a jesting wager of Seb, that he would give it to whomsoever of the company it should best fit. Osiris once secured within the chest, it was towed down the Nile and abandoned at the mouth of the river, to be dashed to pieces in the sea. It became entangled in some debris, however, and Isis, after great trouble, gained possession of the chest. Seb recovered it, took out the body of Osiris, cut it in pieces, and scattered it along the Nile. Isis spent a long time in gathering up the remains, and, assisted by Orus, overthrew Seb, who had assumed the sovereignty, and avenged her husband's murder. By many Osiris seems to symbolize the sun and stars, and Seb winter and darkness, Isis being the moon; while to most he seems rather to stand for the Nile, Isis (as mother earth, or Démeter, with the Greeks) for the earth, and Seb for the sterility of the desert, perpetually warring against the fertility of Osiris and Isis.

OSMAZOME is a name given to that portion of meat extract which is soluble in alcohol, and to which the peculiar taste and odour of meat are due.

OSMIUM, a rare metal belonging to the platinum group, and found in native platinum alloyed with iridium; the ore is known as osmium or iridosmium. It is also found in frite, a chrome iron ore. It was discovered by Tennant in 1803. The metal is reduced from the sulphide at a very high temperature. The symbol is Os, the atomic weight 192. When heated under the oxyhydrogen blowpipe it is malleable, and attains a density of 21.1. It is then a bluish shining metal, hard enough to scratch glass, but it is quite infusible. In the finely divided state it is very inflammable, burning into the tetroxide or osmic acid, which is volatilized. It is obtained in this fine state of division by melting it with zinc, and dissolving out the zinc by hydrochloric acid.

There are five oxides of osmium, the protoxide or osmious oxide (OsO), the sesquioxide (Os_2O_3), the dioxide or osmic oxide (OsO_2), the trioxide or osmious anhydride (Os_2O_5), and the tetroxide or osmic acid (OsO_4). The first three form salts with acids; the two others are weak acids forming salts with bases, called osmides and osmater. Osmic acid is the best known; it is a volatile body, which may be obtained when pure in beautiful crystals. The vapour has a strongly pungent and irritating odour, and is very poisonous; the crystals melt at the heat of boiling water, and the vapour distils over at a little higher temperature. It is soluble in water, and is a powerful oxidizing agent. The solution (1 per cent.) has been recently introduced into medicine for hypodermic injections in strumous gland and cancer.

There are three chlorides of osmium, the dichloride or osmious chloride (OsCl_2), the trichloride or osmioso-osmic chloride (OsCl_3), and the tetrachloride or osmic chloride (OsCl_4). Osmic chloride is the red compound obtained by igniting osmium in chlorine gas. Osmium compounds are detected by the characteristic unpleasant odour of osmic acid which is given off when these are heated with excess of nitric acid; the volatile acid may be condensed, and the metal reduced from it by hydrogen. The metal is thus easily distinguished from the iridium and platinum which usually accompany it.

OSMO'SIS, or **ENDOSMOSE** and **EXOSMOSE**, is the attraction through an animal or vegetable membrane of thin fluid by a denser fluid. M. Dutrochet, its discoverer, in 1828 found that if he filled the swimming bladder of a eel with thin mucilage and placed it in water, the bladder gained weight by attracting water through its sides; to this phenomenon he gave the name of *Endosmose*. He also found that if he filled the same bladder with water and placed it in thin mucilage, it lost weight, its contents being partially attracted through its sides into the sur-

rounding mucilage; this counter-phenomenon he named *Exosmosis*. The same circumstances occur in the transmission of fluids through the tissue of plants. The parts of vegetables may be gorged with fluid by merely placing them in water, and may be emptied again by rendering the fluid in which they are placed more dense than that which they contain. This phenomenon takes place with considerable force. Water thickened with sugar in the proportion of one sugar to two water, is productive of a power of osmosis capable of sustaining a column of mercury of 127 inches, or the weight of $4\frac{1}{2}$ atmospheres.

The subject was reinvestigated with far greater thoroughness by Graham in 1854, and the discovery of dialysis was the result. He eventually divided organic substances into colloids and crystalloids—the first containing gum, albumen, gelatin, &c., and the second salts, acids, and alkalis. The action of osmosis is great upon the latter, feeble upon the former; that is, if a colloid solution and a crystalloid solution be each separated by a membrane from pure water, the crystalloid will pass into the water very much faster than the colloid, say as 20 or 25 to 1 in extreme difference—each class, however, presenting great variety in itself. The very useful power of extracting salt from brine, which is one of the practical applications of osmosis, has been spoken of already in DIALYSIS; and there are many other applications, equally easy and efficacious, of this fruitful principle.

OSMUNDA, a genus of FERNS. *Osmunda regalis* (the flowering fern or royal fern) is a native of Great Britain in boggy places, and often attains a height of from 1 to 8 feet. It acquires its name of flowering fern from the fact of the spore-cases occurring not on the back of the fronds, but so densely covering the upper leaflets that only the midrib is to be seen. It was formerly used medicinally on account of its tonic and astringent properties.

OSMUNDACEE is a group of FERNS characterized by the sporangia being shortly stalked, with a horizontal bar instead of an annulus, splitting longitudinally. There are two genera, *Osmunda* and *Todea*; the former is well known on account of the occurrence of a British species, the flowering fern. *Todea* differs from *Osmunda* in the fronds being not (or only slightly) contracted, the spore-cases being evidently produced on the veins.

OSNABRUCK, a town of Germany, in the province and 74 miles W.S.W. of Hanover, in a valley on the river Hase. It is surrounded with a wall and ditch, and has five gates. Like most of the old German towns it is irregularly built. The most remarkable public buildings are—the palace built in 1665, the cathedral, the Roman Catholic church of St. John, the Lutheran churches of St. Mary and St. Catherine, and the fine town-hall, in which the treaty of Westphalia was concluded in 1648. The inhabitants, numbering about 17,000, are employed in manufacturing woollen cloths, including the coarse linens called *Osnaburgs*, tobacco, chicory, soap, and paper. The chief trade of the town—the export of linen fabrics and cattle—is favoured by its position on the high route between Bremen and the Lower Rhine, and it ranks as the third commercial city in Hanover.

OS'PREY (*Pandion haliaetus*) or Fish-hawk is a bird of prey belonging to the order ACCIPITRINES, forming a distinct family, Pandionidae. The osprey enjoys a very wide geographical distribution, there being few regions in the world which it does not frequent: it is not, however, found in South America south of Brazil, nor in New Zealand, nor in some of the Pacific Islands. It is migratory. In Britain it is rare, but is said to breed in one or two localities in Scotland. It is always found in the vicinity of water, either on the sea-coast or near lakes or rivers inland. The male osprey measures about 22 inches in length, the female being about 3 inches longer

the expanse of the wings is about 5 feet 3 inches. The general colour of its plumage on the upper surface and wings is dark brown, and on the lower surface white, with few brownish feathers on the breast; the tips of the primaries are black, and the tail feathers are banded with two shades of brown. The beak is black, with the cere blue, and the feet are also blue, with black claws, which, unlike those of the birds of prey in general, are not grooved beneath. The wings are very long and powerful. The bill is short, strong, and rounded above. The outer toe is reversible, a character only found elsewhere in the Accipitres among the owls. The under surface of the toes rough, covered with sharp-pointed scales. The feathers have no after-shaft or accessory plume, as in the Falcons.



Osprey (*Pandion haliaetus*).

The nest is composed of an immense mass of rotten sticks and similar materials; it is generally placed in a high tree, but sometimes upon rocks, ruined buildings, or even on the ground. In this the female deposits two or three eggs, of a white colour, blotched with reddish-brown at the large end. Where there is a good supply of food numerous nests are often built close together, forming a society, as it were. The osprey feeds exclusively on fish.

The flight of this bird is peculiarly graceful; and its plunge when sweeping down to secure its finny prey inconceivably rapid and arrow-like; a flash on the surface of the water, succeeded by a white foam, startles the eye; the next moment the bird is seen rising on powerful wings and bearing the prey in its large talons. It is then that its great enemy, the White-headed Sea Eagle (*Haliaetus leuccephalus*), marking its actions from some tall tree or beetling cliff, launches itself into the air, and gives chase to the honest osprey, in order to rob it of its well-earned booty. The aerial manœuvres of the attacked and the aggressor are most interesting. Generally, however, the fish-hawk, hard pressed by his unencumbered antagonist, is obliged to drop his prey; as a flash of lightning down dashes the eagle, and catches it ere it reach the water.

OSSA, a famous mountain opposite to Mount Olympus, the fabled home of the Greek gods. The Vale of Tempé divides the two, and the river Peneus flows between them. Ossa is the lofty north-west spur of the chain of Pelion, whence the myth that the giants in their attempt to reach the abode of the gods piled Pelion upon Ossa, and yet failed. The phrase has passed into a proverb. The modern name of Ossa is *Kissaro*.

OS'SIAN. Ossian or Oisín ("the little fawn") was a Gaelic poet whose works were transmitted orally from bard to bard, till the introduction of the art of writing into the

Highlands afforded the means of fixing them in manuscripts, from which translations were made. In the poems which bear his name, Ossian is described as the eldest son of Fionn MacCumhaill or Fingal, i.e. the fair Gaul (the Fulgentius of Fordun), king of Morven in the West Highlands of Scotland, a prince descended from a long line of renowned ancestors. At an early age Ossian was married to Everallin, daughter of Branno, king of Lego in Ireland, who died soon after the birth of Oscar their only son. Ossian never married again, but in his poems often alludes to his loss and describes the beauty of Everallin. He had several brothers, whose fame he commemorates in his poems. The period at which he lived is disputed. The common belief, however, is that he lived towards the end of the third or beginning of the fourth century. In the fifth century Christianity had gained a footing in Caledonia, and Druidism as an established religion was nearly overthrown. As in the Ossianic poems there is no reference to Christianity, it is scarcely possible to think that he could have lived so late as that period and remained unacquainted with it.

Most of his life was spent in wars; and in old age, when he could no longer handle the spear, he often draws consolation from the remembrance of his early exploits. He lived to an old age, surviving most of his family and companions. In his old age he was deprived of his eyesight. The date of his death, as well as the place of his burial, are matters of uncertainty. What is called the tomb of Ossian is found in Glen Almond, a few miles to the north of Clief, in Perthshire, one of the most romantic glens in Caledonia.

The name of Ossian has become famous all over Europe on account of his poetry. As is well known, James Macpherson first published his "Fragments of Ancient Poetry collected in the Highlands" in 1762. The work was anonymous; but as it professed to give a specimen of a great amount of ancient Celtic poetry still existing in the mainland and isles of Scotland, it was received with the utmost enthusiasm. Macpherson made a tour to obtain further materials, after which he gave to the world "Fingal," an ancient epic poem, in six books; shortly after followed by "Temora," in eight books, with other poems of Ossian. These productions caused an immense sensation, and were translated not only into French and Italian, but also into Danish and Polish; while Macpherson was hailed as the preserver of these relics of ancient culture. A few years later, however, a suspicion began to be entertained that the poems were not authentic; and their genuineness became the subject of as warm a controversy as ever was waged in the annals of literature. That they were what they claimed to be was maintained by Lord Kames, Sir John Sinclair, Dr. Blair, Professor Ferguson, and the poet Gray. That they were more or less the fabrication of Macpherson himself was maintained by Dr. Johnson, Dr. Percy, Mr. Laing, David Hume, and John Pinkerton.

A valuable manuscript in the Advocates' Library, Edinburgh, known as the "Dean of Lismore's Book," was published in the year 1862, by two gentlemen of high standing as Celtic scholars, W. F. Skene, Esq., and the Rev. Dr. M'Lauchlan, of the Free Gaelic Church in Edinburgh. Some of the pieces in this volume contain names which appear in Macpherson's poems, such as Fingal, Gaul the son of Moriri, Oscar the son of Ossian, Garve the son of Sturno, the Dames, Cuchullin, &c. From these it is evident that Macpherson at least made use of persons and names familiar to the Highlanders of Scotland for centuries.

The so-called *originals*, published by Sir John Sinclair in 1806, turn out to be all in the handwriting of Macpherson or his amanuensis. In this case the term "original" has no other meaning than that commonly applied to the manuscripts sent by an author to the press. In no single instance is any particular poem, or any particular part of a

poem, distinctly traced by such evidence from its original possessor to the pages of Macpherson's volume. All the testimony we have on this point is, that Macpherson did receive some manuscript fragments of Gaelic poetry, and had others recited to him; but it seems very clear that he filled up or interpolated these according to his own taste. The committee of the Highland Society of Scotland appointed to examine the subject reported as follows:—"It (the committee) is inclined to believe that Macpherson was in use to supply chasins, and to give connection, by inserting passages which he did not find, and to add what he conceived to be dignity and delicacy to the original composition, by refining the language, by striking out passages, by softening incidents; in short, by changing what he considered as too simple or too rude for a modern ear, and elevating what, *in his opinion*, was below the standard of good poetry. To what degree, however, he exercised these liberties it is impossible for the committee to determine." The poems which Macpherson copied from recitation could only be known to himself, and we can only attain to an approximation of their importance from knowing what trustworthy scholars have found after travelling over the same ground. On the whole, it may be concluded that Macpherson is, in nearly the strictest sense of the term, the author of the English poems of Ossian. He may have received the skeleton, but it was he who clothed it with flesh and gave it the form which it now wears.

While the Macpherson controversy was raging, another speedily arose in Ireland, where the same feelings of nationality, which were so strong in Scotland in defence of the authenticity of these poems, were arrayed in opposition to them. The Irish maintained that Finn, Ossian, and Oscar belonged to Ireland. The claims of the Irish have never been satisfactorily answered. The Ossianic poems, so far as original, ought certainly to be considered primarily as Irish compositions relating to Irish personages, real or imaginary, and to Irish events, historical or legendary; but having been long preserved and diffused in the Scottish Highlands, and the date or first commencement of these compositions being of great antiquity, they belong as much to the ancestors of the Scottish as of the Irish Celts.

OSSIFICATION, in physiology, means the formation of bone, which always proceeds from certain definite points for each bone, called *centres of ossification*. See the article BONE.

OSSIFICATION, in pathology, is an unnatural formation of bone. It is most frequent in the cartilages of the ribs, in which it almost constantly occurs in advancing years. The change is generally earlier in men than in women, and it affects the cartilage of the first rib sooner than the rest. Next to the cartilages of the ribs those of the windpipe are most liable to become osseous. Ossification of the cartilages of the ear, nose, and Eustachian tube is, on the contrary, extremely rare, and in the few cases in which it occurs it is not particularly connected with old age. The cartilages of the movable joints never ossify. The tendinous tissue is that which, next to the cartilaginous, is most subject to ossification. This change is not uncommon at the insertion of the tendons of muscles that are much exerted, and in the ligaments of some fixed or scarcely movable joints. Small pieces of bone are also not unfrequently formed in the dura mater, and these are one of the sources of incurable epilepsy. Bone is also sometimes formed in the fibrous coats of the spleen and liver.

Ossification occasionally takes place in the false membranes produced by acute inflammation of the pleura, and more rarely in those of the pericardium; and it is a common process in the adhesions which form between the heads of bones exposed by ulceration of their cartilages, producing the most fixed kind of ankylosis of the joints. A few cases are recorded of ossification of the muscles. In many

cases the material formed exactly resembles true bone in its minute structure and chemical composition. In other cases, as in ossification of the heart and arteries, the substance deposited is composed of carbonate and phosphate of lime, as bone is, but its particles have no definite arrangement. That which is called ossification of the heart is not an affection of the proper substance of that organ, but of its valves, in which earthy matter is sometimes deposited, so as to render them stiff and unyielding and destroy the pliancy which is necessary for the performance of their functions.

OSTADE, ADRIAAN JANSZ VAN, the famous painter, was born in 1610 at Lübeck; but though a German by birthplace he is purely Dutch in art, having formed his style in Holland, where he studied under Frank Hals. There is such delicacy in his pencil, such warmth, transparency, and brilliancy in his colouring, and such a profound knowledge of chiaroscuro, that it is impossible not to admire his genius and execution, though his subjects are frequently coarse and vulgar.

His best works are extremely scarce and sell at very high prices. Few of them are in the English collections. There are four at Dulwich College, and but one ("The Alchemist") at the National Gallery. His best work is to be found at the Hague, and among the twenty gems of the master at St. Petersburg, and the fine collection at Dresden. His habit is not to generalize the light, like Teniers, whose choice of subjects is much the same, but to concentrate it, after the manner of Rembrandt, in a most powerful and striking fashion. Adriaan Van Ostadé died in 1685.

ISAAC JANSZ VAN OSTADE, born at Lübeck in 1617, was the brother of Adriaan, from whom he learned the art of painting, and whose manner he closely imitated. He chose different subjects, however, preferring landscapes to the interiors of Adriaan. He made for himself a specialty of winter landscapes in particular, and is considered generally to be the first master in this peculiar walk of art. Two splendid frost scenes and a village scene well represent him in the National Gallery. He died young, probably about 1649.

OSTEND' (*Ostende*), a fortified town and seaport of Belgium, in the province of West Flanders, 88 miles by railway west by north from Brussels, has about 20,000 inhabitants. It stands upon a plain, and is much frequented during the summer as a watering-place—occasionally by the Belgian court. The marine promenade is one of the finest in Europe, and there are also a handsome park, pavilion, and Karsaal. Ostend has great facilities for carrying on trade with the interior by means of canals and railways, and ranks as the second seaport in the kingdom. It has daily communication with London and Dover by steam packets. The port is safe, though the entrance is obstructed by sandbanks, and there is also a large inner harbour. Vessels of 200 and 300 tons pass by canal from Ostend to Bruges. The industrial establishments comprise sugar and salt refineries, linen, sailcloth, and soap factories, rope-walks, &c. There are also active cod, herring, and oyster fisheries. The imports consist chiefly of coal, colonial produce, wool, and British manufactured goods; the exports, of apples, eggs, butter, chicory, flax, glass, hops, paper, poultry, rabbits, and oysters. Nine-tenths of the trade is with the United Kingdom. Two handsome and extensive floating basins were completed in 1874, and fine quays for the accommodation of passengers by the mail packets were opened in 1875.

Ostend was inclosed with walls by Philip the Good in 1445, but was not regularly fortified until 1583. The Dutch sustained a siege by the Spaniards, which began in 1601 and lasted until 1604, when it surrendered by capitulation. The town was taken by the allies in 1706, and in 1715 it was ceded by Holland to the Emperor of Germany. Louis XV. took it in 1745, after a siege of eighteen

days, in which the town was greatly injured, and restored it in 1748. In 1794 it was taken by the French, and remained in their possession until 1814, having been unsuccessfully attacked by the English in 1798.

OS'TIA, OS'TIUM TIBERI'NUM, the name of the former port of Rome, situated at the southern mouth of the Tiber, is 14 miles from the capital. The ancient town of Ostia, which was situated below the fork of the river, spread in a semicircular form along a bend made by the left or southern branch, on a piece of ground slightly elevated above the surrounding sand and marshes. Ostia was founded by Ancus Marcius, according to Strabo. In the course of time it rose, with the rise of Rome, to be a place of great wealth, population, and importance. It was taken by Marius, who appears to have treated it with great severity. ("Livii Epit.," lib. lxxix.) But it soon recovered from this disaster, and continued for a lengthened period to engross the whole trade of Rome carried on by sea. But its port had never been good; and, owing to the gradual accumulation of mud and other deposits brought down by the river, it ultimately became inaccessible to ships of considerable burden, which were obliged to anchor on the coast in an exposed and hazardous situation. Many efforts were made at different periods to obviate these inconveniences, but apparently without much success; and at length the Emperor Claudius determined to construct a new port (*Portus*) at the mouth of the north or right arm of the Tiber. This harbour was wholly artificial, and was formed at a vast expense by moles projecting into the sea. (Sueton. in Claud., cap. 20; Dio Cassius, lib. lx.) The port constructed by Claudius was repaired by Trajan; but the same circumstances that had destroyed the harbour of Ostia very soon began to choke up the new port; and instead of attempting to improve the latter, Trajan judged it more expedient to construct a totally new harbour at Centumcellæ, now Civita Vecchia, though the latter was more than double the distance of the former from Rome. ("Plinii Epist.," lib. vi. ep. 31.) The harbour formed by Trajan is at this moment the best by far on the west coast of Central Italy. The great works, the construction of which is described by Pliny, still remain entire. The modern village was founded in 830, and became of some importance in the middle ages, but is now almost deserted.

OSTRACISM (Gr. *ostrakismos*, from *ostrakon*, a potsherd, tile, or voting tablet; derived ultimately from *ostron*, an oyster—possibly the earliest form of voting tablet being an oyster shell), the name for a singular institution existing for some time among the Athenians. When any man became conspicuous by wealth or by power, and was in consequence thought likely to conceive plans of ambition dangerous to the stability of the existing form of government, this institution enabled the Athenian people to send him for a time into exile, and thus rid themselves of the danger which they dreaded. This especially was the case when the rivalry of two great men seemed to threaten peril to the state. When the occasion was thought to require it, a day was fixed at an ordinary meeting of the Athenian people for the purpose of holding an *ostracism*. On that day a part of the market-place was railed in, ten different approaches being left to the part thus railed in. There was thus one approach for each of the ten Athenian tribes. By these approaches the citizens, distributed according to their tribes, entered the space within the rails, and there deposited, in urns provided for the purpose, their shells or bits of earthenware (Gr. *ostraka*), marked with the name of the person whom they respectively thought it desirable to banish. The nine archons, together with the *Proedroi* and *Prytanes*, superintended, seeing that everything was done properly, and in the end counting the votes. First of all they counted the gross number, which it was necessary should be above 6000, else there was no valid ostracism.

If there were found to be 6000 votes, they then proceeded to count the numbers against the different individuals, if more than one were under sentence; and, according to the account given by Plutarch, the individual against whom there was the greatest number of votes was sentenced to banishment, or, in other words, was *ostracised*. According to the scholiast on Aristophanes and Pollux, it was necessary that there should be 6000 votes against the individual ostracised, and that a mere majority short of 6000 was not sufficient. The person thus ostracised was obliged to leave Athens within ten days after the sentence, and unless a vote of the people recalled him before the expiration of that time, he remained in exile for ten years. The goods of the ostracised person were not confiscated; neither was ostracism considered a disgrace. It passed for what it was, a declaration of superior wealth or superior influence, whose ascendancy the state dreaded. It is well known that Aristides the Just, whose public integrity and private virtues have made his name proverbial, was one of those on whom ostracism was inflicted.

A similar institution is said to have prevailed in Argos, Miletus, and Megara. At Syracuse also it was in vogue, and there bore the name *petalism*, leaves (*Gr. petala*) being used on the occasion of voting instead of shells.

OSTRICH (*Struthio camelus*) is a bird belonging to the order STRUTHIONES (or Ratiſſe). The ostrich is tolerably abundant in Africa, from Southern Algeria to Cape Colony, but is not found in Egypt or Nubia. In older days it was found in India and Central Asia, and even at the present day it is found in Syria and Arabia. The ostrich is mentioned several times in the Old Testament, where the Hebrew word is often rendered *onk*.

The ostrich is the largest living bird, and is not far inferior to the gigantic extinct Moa of Australia, for a full grown male will stand nearly 8 feet high and weigh 300 lbs.; the female is rather smaller than the male. The general appearance of this majestic bird is so well known as not to need detailed description. Travellers in Africa have frequently remarked the strong likeness to a camel which this bird presents, especially when seen at a distance; by the ancients indeed it was called camel-bird, and both Aristotle and Pliny considered it half-bird, half-quadruped. The plumage of the male is a glossy black, except the long plumes of the wings and tail, which are white; the females and the immature males are dark gray. In the feathers the webs are exactly equal on each side of the shaft, an equality which so impressed the Egyptians that they made the feather an emblem of justice. The head and neck are nearly naked. The wings are very short and quite useless for flight. The legs are very long and powerful, covered with hexagonal scales, and terminated by two toes.

The ostrich is polygamous, the cock bird being found associating with three or four hens, who lay their eggs in a common nest, consisting of a shallow pit scraped out in the sand by the feet. The birds sit on the eggs during the night, the male assisting in incubation, but during the day the eggs are usually left exposed to the heat of the sun. A large number of eggs, thirty or more, are deposited in the nest, and around are scattered many more, which are said to be broken by the parent birds for the purpose of feeding the newly hatched young. Incubation lasts about six weeks. Each egg weighs about 3 lbs., and equals twenty-four eggs of the common fowl in capacity.

The ostrich is a very omnivorous bird, nothing appearing to come amiss to it as food—seeds, berries, fruit, grass, leaves, beetles, locusts, small birds and mammals, lizards, and snakes; the process of trituration and digestion being aided by sand, stones, and bones. Though it can dispense to a certain extent with water, and usually inhabits arid districts, it is fond of bathing, even resorting, according to Von Henglin, to the shores of the Red Sea for that pur-

pose. Its cry, according to Livingstone, is indistinguishable from the roar of the lion, but according to others it is a hoarse wailing.

The ostrich is very fleet of foot. The length of its ordinary stride is estimated at 12 feet, and its rate of travelling at 25 miles an hour, but according to Canon Tristram, when in full speed its stride measures from 22 to 28 feet. Owing to this extraordinary swiftness the pursuit of the bird is attended with considerable difficulty. From ancient days hunters have contrived to approach it without suspicion by means of a curious stratagem—clothing themselves in an ostrich skin, approaching the flock from the leeward, and imitating their movements so exactly as to be allowed to come close and shoot the birds one by one with arrows. Ostriches are also hunted on horseback, advantage being taken of the habit of these birds to run in a circle. When run down the bird often defends itself with its legs, inflicting terrible kicks. The flesh, especially of the young bird, is said to be palatable, and the eggs are relished by the bushmen.

Within recent years "ostrich farms" have been formed at the Cape of Good Hope and various other places, with very profitable results, the birds becoming remarkably tame; and if the increasing demand for ostrich plumage is to be supplied the enterprise was not undertaken any too soon, reckless capture and destruction having well-nigh exterminated the birds from many parts. The chief requisite for an ostrich farm seems to be abundance of land, a space of 600 acres being requisite for 100 birds. Artificial incubation has been attended with considerable success. At the Cape, while in 1865 there were but eighty tame birds known there, in 1886 there were no less than 60,000. The quality of the feathers produced by tame ostriches is fully equal to the best collected from wild birds, while the general average is much higher. The feathers may be either plucked, or to avoid any pain, cut with a knife, the stumps afterwards falling out. A new feather grows to its full size in from six to eight months. The pure whites from the wings are called "bloods," the next quality "prime whites," "firsts," "seconds," and so on. The tail feathers are not so valuable. "Bloods" fetch from £10 to £50 per pound weight in the wholesale market; and from this price the feathers descend to as low as 5s. per pound. The finest feathers come from Aleppo. The American ostriches, the Rheas or Nandus, belong to the genus RHEA.

OSTROGOTHS or EASTERN GOTHS, a division of the Gothic nation, which, being driven before the Huns, settled in Pannonia in the fifth century of our era, whence they extended their dominion over Noricum, Rhetia, and Illyricum. About the year 482 or 483 their king, Theodoric, was serving as an auxiliary under the Emperor Zeno, and distinguished himself in Syria. He afterwards invaded Italy, defeated Odoacer, who had overthrown Romulus Augustulus and destroyed the Roman Empire of the West, and made himself king of Italy, with the consent of Zeno, 489. The Ostrogothic kingdom of Italy lasted till 554, when it was overthrown by Narses, the general of the Emperor Justinian. Its capital was not Rome but Ravenna.

OSTRYA (Hop Hornbeam) is a genus of trees belonging to the same order [see CUPRIFERÆ] as the hornbeam, hazel, oak, birch, &c. The hop hornbeam is so named from its likeness to the hornbeam, except that the female flowers are arranged in close catkins, like hops. In the Common Hop Hornbeam (*Ostrya vulgaris*) the catkins are pendulous. This tree is a native of the South of Europe, and was first introduced into England in 1724. It is quite hardy, and in favourable situations grows almost as large as the hornbeam. The Virginian Hop Hornbeam (*Ostrya virginica*) is a native of North America, and is by many considered to be only a variety of the former species; it differs in the catkins being upright instead of pendulous.

OS'WALD (also called *St. Oswald*), King of Northumbria, and Bretwalda or overlord of all England in early English times, long before the supremacy of Wessex, was the son of Æthelrith and nephew of Eadwine, the great Northumbrian princes and bretwaldas, the latter of whom founded Eadwinesburh (Edinburgh) as his northern capital. Eadwine was converted to Christianity by the missionary Paulinus, through his marriage with a princess of Christian Kent; and was slain at Heathfield in 633, in an inrush of heathendom against the new religion, led by the heathen Penda, king of Mercia. After a season of depression and disorder, Oswald, who had been exiled by the late king, his mother's brother, succeeded in gaining the throne of Eadwine. His first act was a vow to finish the great stone minster at York, which Eadwine had begun, a vow he afterwards nobly accomplished, burying Eadwine's head, recovered from the heathen, in the porch. Gathering all the force he could under the shelter of the old Roman wall, he raised the cross as his standard and made head against the victorious heathens. Oswald held the cross with his own hands as the enemy came on near Hexham, in the place afterwards called "Heaven's field," while others rapidly heaped a mound around its foot to sustain it erect. Then after a brief prayer, kneeling, all rose to receive the heathen onslaught. Cadwallon, a Welsh king of Strathclyde (Cumberland, Lancashire, &c.), and Penda's great ally, was their leader, but the faith of the new converts lent them almost miraculous strength, and Cadwallon fell, and his army was hopelessly routed (635). Thenceforth and for seven years Oswald was the greatest prince in all England. As for the power of Strathclyde it was practically destroyed. The cross of Heaven's field was held to have performed a miracle, and pieces of it worked wonders here and there. The Roman clergy had all fled with Paulinus on the death of Eadwine. Oswald looked for a successor, and found one in Corman, a priest of the Irish missionary settlement off the coast of Scotland in the island of Iona, where he himself had found refuge for years. Corman was over-harsh with his penitents, and the faith made little headway till he was replaced by the gentle, loving Aidan, also an Irish monk of Iona. Aidan became Bishop of Lindisfarne, thereafter called Holy Island, and for some time the see of Northumbria. On its wild shores the good Aidan would sit and preach to the rude northern thanes and their half-savage followers, while Oswald served the humble office of interpreter, as Aidan knew Anglian but imperfectly, while Oswald, in the long exile of his youth at Iona, had thoroughly learned the Celtic tongues. He would even accompany Aidan for this purpose on his long missionary journeys. Oswald also caused the conversion of Wessex, with which kingdom he sought to become allied in marriage; befriending and protecting, on his journey thither for that purpose, the missionary Birinus, sent from Rome, who had hitherto met with no favour. Oswald aiding him, Birinus baptized the king and court of Wessex. Unhappily Penda, the great heathen prince of Mercia, overthrew the good Oswald in a second Mercian invasion. Penda had conquered the tributary (Christian) kingdom of East Anglia. Oswald advanced to his relief, but fell in the battle called Maserfield (Oswestry), in 642. His brutal conqueror hacked his body in pieces and stuck them on stakes; but the hand of the good king, which had so often blessed his people, remained white and incorruptible. His memory was revered as that of a saint; miracles were worked by the blood-stained dust of the place of his martyrdom. His last words were said to be a forgiveness of his enemies, "Lord, have mercy on their souls."

OSWEGO, a flourishing city in the state of New York, United States, on the south-east shore of Lake Ontario, on both sides of Oswego River, 150 miles W.N.W. of Albany. It is well built, and its port, after that of Sackett, is the best on the lake. By the Oswego Canal it communicates

with the Erie Canal, and thus receives a great part of the transit trade for the west. It is chiefly notable as a grain port, and for its mills and corn factories. Its streets are wide, and it has several fine buildings, the chief of which are the custom-house, post-office and court house, the city hall, state armoury, library, and several churches. The population in 1880 was 20,118.

OS'WESTRY, a market-town and municipal borough of England, in the county of Salop, situated 16 miles north-west from Shrewsbury, and 191 from London, on the Cambrian and a branch of the West Midland railways. The town is well paved, and is increasing in extent. It contains a town-hall. The church, erected since 1616, is spacious, and surmounted by a small tower. Another church was built in 1837, and a chapel for the grammar-school was erected in 1863. The national school is a handsome structure; there are two market-houses, and several dissenting chapels. The town contains some extensive workshops in connection with the Cambrian Railway, and a considerable trade is done in malt and the agricultural produce of the surrounding district. Oswestry from 1461 to 1621 was the great mart for woollens called Welsh webs. The population of the municipal borough in 1881 was 7847.

Oswestry is an ancient town of Saxon origin, formerly called Maserfield. It derived its present name from the northern king Oswald and the adjunct *tre*, or town. Oswald, king of Northumbria, was slain here in battle in 642, while endeavouring to dispossess Penda, king of Mercia, of his territory. As he had been a benefactor to many monasteries, he was canonized. When Offa constructed the barrier which still bears his name, Oswestry stood between it and Watt's Dyke, which ran parallel to the former at a distance of 2 miles. It was rendered a border town, and became the scene of frequent contests, first between the Saxons and Britons, and at a later period between the Britons and Normans. In 1212 (under its lord, Fitz-Alan) it was taken and burnt by King John, as also in 1235 by the Welsh prince Llewellyn. During an insurrection of the Welsh, under Owen Glyndwr, in 1400, Oswestry was again nearly destroyed by fire. The town was formerly well guarded by a castle, supposed to be of Norman origin, which stood on an eminence to the north, and of which only a few fragments now remain.

OSWI or **OSWIO**, King of Northumbria, and Bretwalda or overlord of all England from 642, or soon after, to 670, was the brother of St. Oswald, the great king of Northumbria, whom he succeeded. Oswald had been a true Christian, but it was Oswi who really first caused the creation and organization of a national church, although in zeal and purity of faith, and in life, he could not for a moment be compared with his saintly brother. Oswi began his reign with an abominable crime. He succeeded to Bernicia (North Northumbria), and his cousin Oswine to Deira (South Northumbria). Without excuse he marched upon the latter, who was universally beloved, and especially by the holy Aidan, bishop of Lindisfarne, and informally the primate of the north, and before Oswine could meet him in battle Oswi caused him to be most treacherously murdered. He loudly professed repentance, and succeeded in winning forgiveness of the outraged church and people, so that when he met Penda and the Mercians in a pitched battle at Winwood, near Leeds, he was well seconded by the whole of Northumbria, defeated and slew Penda, and a sudden rising of the river, held to be miraculous, swept away the retreating conquered host and broke the heathen power in England for ever (655). Mercia, not long after, became Christian, Oswi governing it by viceroys of his own for some time, and even when Penda's son, Wulfere, came to the throne, retaining full and complete overlordship over the state. The conversion of Mercia was due to St. Chad, a monk from Northumbrian Lindisfarne, and the Cathedral of Lich-

field, the ancient capital of Mercia, is dedicated most appropriately to him. The conversion of Northumbria, especially of what we now call the "border," was completed by St. CUTHBERT, a native of Lannernoor and a pupil of a missionary out-station of Lindisfarne, located at Melrose. This was also the time of the inspired singer Cædmon, in the abbey of St. Hilda, at Streonshalh, by Whitby, where afterwards Oswi was buried and the headless body of Eadwine lay. In the separate articles under those titles the labours of these devoted men are detailed. But it must be noticed that they are all Irish monks by spiritual descent, differing from Rome in countless minor points, such as the tourse of the forehead and crown only, the dates of festivals, order of service, &c., and in the one great point of complete independence of papal rule. Wilfrith, bishop of York, the first Englishman distinguished in the church, Benedict Biscop, abbot of Wearmouth, and the queen of Oswi, worked zealously for Rome, and at last the puzzled king called the famous Saxon or Wiltshire, at which, after hearing both parties on the various points of dispute, he decided for Rome. Wilfrith became archbishop, and Theodore of Tarsus, a Greek monk, immediately hurried off by the Pope, soon arrived in England to organize the whole English Church on the Roman model. Canterbury was made the primal see, and York the second to it. Colman, the head of Lindisfarne, fled with his Irish monks, and Holy Island (Lindisfarne) sank into obscurity. Oswi was the most powerful sovereign that had as yet reigned in Britain, and he left an apparently settled inheritance of vast power to his successor, Egfrith, on his death in 670. That inheritance was destined to pass utterly away in fifteen years, when the supremacy of Northumbria was overthrown by the ruin of Egfrith at Nechtansmere in 685; and the tide of power drifted gradually southwards till the rise of Wessex created a new overlordship for England.

OTAGO, a provincial district of the South Island, New Zealand, embracing the whole of that portion of the island which lies S. of 44° 20', and the Waitangi or Waitaki River. Area, 25,060 square miles. The greater portion of the country is mountainous, especially in the west, where the summits of Earnslaw and Mount Aspiring rise to 9165 and 9049 feet. The chief rivers are the Waitaki, Molyneux, and Oreti, all flowing east and south-east. The climate is bracing. Snow lies for weeks on the plateaus in winter. Mean temperature of lowlands, 50°; maximum, 86°; minimum, 21° Fahr. The Oamaru plains along the east coast have rich soil, and large tracts are available for pasture. Stock raising and wool export are the chief industries. Gold mining is productive. The chief towns are Dunedin, on Port Otago, and Invercargill. The southern portion of Otago was separated from it in 1861 as the province of Southland, but was re-united in 1870. The settlement in Otago was made in 1848. The population is about 120,000.

OTAHETI. See TAHITI.

OTHO, MARCUS SALVIUS, was born on the 28th of April, A.D. 31 or 32. He was descended of an honourable family, which originally came from Ferentinum (Ferentino). His father was very high in the favour of Tiberius, whom he resembled in person. Marcus was the younger son. His elder brother Titianus serving, like himself, most of the great offices of the empire. During the early part of Nero's reign Marcus Otho was his intimate friend and the companion of his debaucheries; but Nero's love for Poppæa, whom Otho had seduced from her husband, produced a coolness between them, and occasioned the honourable banishment of Otho to the province of Lusitania, of which he was appointed governor. In this province, which he governed, according to Suetonius, with great justice, he remained for ten years; and afterwards took an active part in opposition to Nero and in placing

Galba upon the throne, A.D. 68. When Galba adopted Piso Licinianus as his successor, Otho formed a conspiracy among the guards, who proclaimed him emperor, and put Galba to death, 15th January, 69 A.D.

Otho commenced his reign by ingratiating himself with the soldiery, whom Galba had neglected to conciliate; but his career was short. Vitellius, who had been proclaimed emperor at Cologne, by the legions in Germany, a few days before the death of Galba, sent Cæcina, one of his generals, to secure the passes of the Alps, while he himself remained in his camp upon the Rhine. Otho marched against Cæcina, and at first was successful; but his army was defeated by the troops of Vitellius in a hard-fought battle near Bedriacum, a village on the Po, south-west of Mantua. When Otho, who was not present at the engagement, heard of the catastrophe, he committed suicide, 16th April, 69, at Brixellum, now *Bregella*, a town of Cisalpine Gaul, situate on the right bank of the Po.

OTITIS, or inflammation of the tympanic cavity of the ear, may arise from exposure to a draught of cold air, from the rush of sea-water into the ears while bathing, violent syringing, probing, or other similar causes. It is a condition constantly seen after scarlet fever, measles, and other febrile diseases, weak, unhealthy, and neglected children being frequent victims. The symptoms are sudden and severe pain in the ear, the intensity of which is increased by coughing, sneezing, or swallowing, a feeling of fullness in the ear, tenderness or soreness in its vicinity, singing or buzzing noises in the head, more or less deafness, and high fever sometimes accompanied by delirium. If the disease goes on unchecked, matter forms in the interior of the ear, the tympanic membrane may ulcerate and become perforated, the matter being discharged externally. It is a serious affection, and one that calls for early and careful medical treatment. The attendant fever must be subdued by the administration of suitable internal remedies, and hot fomentations or poultices may be applied externally. Where there is any discharge the ear must be frequently washed out, and gently but thoroughly dried. In favourable cases the opening in the tympanic membrane closes up as the inflammation subsides, and the complaint leaves very little, indeed sometimes hardly any, appreciable deafness. Where, however, the complaint is neglected or improperly treated, and the purulent discharge is allowed to continue for any length of time, it is the exception for the perforation to heal. The aperture left may vary in size from a small pin-hole to nearly complete loss of the membrane, and similar variations in hearing accompany this condition between slight deafness and total loss of hearing power.

OTOLITHS or **OTOCONIA**, small detached crystalline pulverulent masses, which lie in the vestibule of the labyrinth of the ear, and seem to serve first to reinforce the sonorous vibrations by resonance, and secondly also to make them more perceptible by their vibrations, lying as they do on the membrane in which are the nerve-fibres of the vestibule of the ear, and transmitting vibratory movement more definitely to the membrane and the nerves than the fluid of the labyrinth can do. See EAR.

OTOMACS, the name of a South American tribe of Indians, living in the rudest state of nature on the banks of the Orinoco and its tributaries. Humboldt describes them as *geophagists*, or earth-eaters. He found in their huts pyramidally-formed heaps of clay, preserved for the purpose of satisfying the calls of hunger. It was of a fine and unctuous quality, consisting of silica, alumina, and lime. When the waters of the river are low they live on fish and turtle; but when the rivers swell, and it becomes difficult to procure food, the Otomacs resort to this clay as their common aliment.

OTORRHEA is a purulent or mucopurulent discharge from the external ear. In the case of weak sickly

children it sometimes follows an ordinary cold. It most frequently results from scarlet fever, but it may come on after any exhaustive illness, or appear as a result of struma or gout. The treatment during the acute stage must be constitutional and local, the ear being syringed with warm water, and warm fomentations being used. In the chronic stage the strictest attention must be paid to cleanliness, and the discharge must be checked by astringent injections. A drachm of alum in a pint of water is an excellent application of this kind, and when the discharge is very fetid a weak solution of Couduy's fluid or carbolic acid may be used with advantage.

OTTAR OF ROSES. See ATTAR OF ROSES.

OTTAVA RIMA (Ital., octuple rhyme) is a form of versification borrowed from the Italians, and much employed in poetry of a mixed character, where the humorous predominates over the serious, as in Byron's "Don Juan," "Beppo," &c., and Pulci's "Morgante Maggiore." It consists of stanzas of two alternate triplets, closed with an heroic couplet, as in the following example, where Haidee discovers Juan after his shipwreck:—

"And she bent o'er him, and he lay beneath,
Hushed as the babe upon its mother's breast,
Drooped as the willow when no winds can breathe,
Lulled like the depth of ocean when at rest,
Fair as the crowning rose of the whole wreath,
Soft as the callow eyneet in its nest;
In short, he was a very pretty fellow,
Although his woes had made him rather yellow."

Here it will be seen that the first, third, and fifth lines have the same rhyme; so, too, the second, fourth, and sixth; while the seventh and eighth correspond to each other, and usually carry the sting or point of the stanza.

OT-TAWA, a large river of Canada, rising in the low ridge separating the basin of Hudson Bay from that of the St. Lawrence, about lat. 48° 30' N., 77° 30' W., flowing south into Grand Lake, thence south-west into Lake Temiscaming, afterwards S.S.E., E.S.E., and east, dividing the province of Ontario (Upper Canada) from that of Quebec (Lower Canada), sometimes expanding into beautiful lakes, and at others foaming through countless wooded islands, or forming rapids and falls. The most celebrated of the latter is that of Chaudiere, at the town of Ottawa, 40 feet high, and almost unrivalled for its peculiar beauty of scenery, though the appearance of the fall itself has been much impaired by its utilization as the motive power of gigantic saw-mills. The Ottawa joins the left bank of the St. Lawrence at the Island of Montreal; length, 800 miles; area of basin, 80,000 square miles. It has a great volume of water; steamers ply on it, and its navigation is continued by the Mattawa tributary to Lake Nipissing, and thence to Georgian Bay of Lake Superior. The Rideau Canal connects it to Lake Ontario.

OTTAWA, formerly *By Town*, the capital of the Dominion of Canada, in the province of Ontario, situated on the south bank of the Ottawa, where the Rideau River joins it, 87 miles from its mouth, and 126 from Montreal. Near the city on both rivers are fine falls, those of Chaudiere being crossed by a suspension bridge, which connects it with its suburb of Hull. As yet the town is somewhat unfinished, but it is rapidly improving, and as the seat of government contains the Parliament House and other official buildings, forming one of the finest edifices in North America, a handsome Roman Catholic cathedral and college, the city hall, and custom-house. Ottawa is the chief lumber mart of Canada, and besides its extensive saw-mills it has several iron works. The population in 1881 was 27,417. Ottawa was constituted by the crown the capital of the Dominion of Canada in 1858, and is the seat of the Dominion Parliament. The foundation stone of the requisite buildings was laid by the Prince of Wales during his visit in 1860. Its convenient position,

as central to the two main divisions of the colony, led to the selection.

OT-TER is the name of several aquatic carnivorous animals belonging to the family *MUSTELINÆ*, and genera *Lutra* and *Enhydra*. The Common Otter (*Lutra vulgaris*) may be taken as the type of the genus *Lutra*. The whole structure of this animal is admirably adapted for its semi-aquatic existence. The body is much elongated, and supported on short limbs. There are five digits to the feet, united by a strong thick membrane, and terminated by short, compressed, curved claws. The tail is flattened from above downwards, very strong and broad at the base, and gradually tapering to the tip, forming a very efficient rudder. The head is small, broad, and flat, with a broad muzzle; the ears are small, short, and rounded; the eyes are large and prominent. The fur is very fine and soft, made up of two kinds of hair; the under fur consists of soft, short hairs of a whitish-gray colour, brown at the tips, and interspersed with these are longer, stiffer hairs, rich brown on the upper surface, and lighter beneath. The length of the body is about 2 feet 2 inches exclusive of the tail, which measures about 16 inches. A full-sized male otter weighs about 24 lbs., the female a few pounds less.

The natural food of the otter consists of fish, of which it destroys great quantities in its native rivers and lakes. The fish when seized is carried to the bank and there devoured, the otter commencing with the head, and frequently, if its prey be plentiful, leaving the rest of the body untouched. The otter makes a kind of nest in the hollows of the banks of the river, or beneath the roots of trees. When pressed for food it will go far inland and plunder the poultry-yard, and even attack lambs and sucking pigs. Nor is it confined to fresh waters, for in the north of Scotland otters are known to frequent the sea-shore, and hunt very far out to sea.

The otter is quite capable of domestication, and may be trained to catch fish for its master; in India and China the species common there are regularly trained for this purpose. The flesh is coarse and has a fishy flavour; from this fact, added to the animal's aquatic habits, it was considered lawful food on fast days. The female brings forth from three to five young at a birth.

The common otter is distributed throughout the greater part of Europe and Asia. In England it is becoming very scarce, and is almost extinct except in a few counties; in Ireland it is more common. Otter-hunting was at one time a favourite sport.

The Canadian Otter (*Lutra canadensis*), a larger species, is widely distributed throughout North America. Many other species of this genus are found in various parts of the world, all agreeing generally in habits and appearance.

The Sea Otter (*Enhydra lutris*), the only species of the genus *Enhydra*, is a remarkable form, presenting in many parts of its structure an approximation to the seals. The length of the body is rather more than 3 feet, exclusive of the tail, which is about a foot more. The head is very short and rounded posteriorly; the ears are remarkably small and placed on a much lower level than the eyes; the whiskers are short but stout. The limbs are short, more especially the fore anterior pair, and the fore feet are small and furry. The hind feet are large and flat, covered with a dense fur, and much resembling a seal's flippers. The under fur is beautifully soft and fine, of a dark brown colour; the outside fur is whitish, giving the whole a frosted appearance. The dentition is very peculiar, there being only two incisors on each side in the lower jaw, and the molars have rounded blunt cusps. The sea otter is found only on the shores of the North Pacific, especially in the Aleutian Islands and Alaska, extending as far south as Oregon. It is essentially a marine animal, and feeds on clams, crabs, and other crustaceans. It is hunted by the Aleutian

islanders for the sake of its fur, which is a valuable article of commerce.

OTTERBURN, a township of England, in the county of Northumberland, 19 miles W.N.W. of Morpeth, celebrated for the battle fought here in 1388, commemorated in the ballad of "Cheivy Chase."

OTTER-HOUND is a variety of hound employed in the chase of the otter. As it is necessary that otter-hounds should not only have good noses, but take the water freely, some care is necessary in attending to the breed, if a good pack is to be the result. A cross between the harrier and terrier is recommended.

OTTO OF ROSES. See **ATTAR OF ROSES**.

OTTO or **OTHO THE GREAT**, King of Germany, and Emperor, was the son of Henry the Fowler, king of Germany. He was born in 912. In 930 he married the English princess Eadgyth, daughter of Edward the Elder, the son of Alfred the Great. Immediately on his election at the death of his father, in 936, Otto had to fight for his crown; and it was some time before, by the conquest of the Dukes of Franconia and Lotharingia, the transfer of Bavaria to his brother, and of Swabia to his son, he became really master of his nominal kingdom. He was at length the most powerful monarch since Charles the Great, and as strong abroad as he was at home. He compelled Harald Blaatand ("blue tooth") of Denmark to acknowledge his supremacy, and set up the "Mark" of Sleswig as a defence of the Danish-German borderland. He made the Duke of Poland do homage for his duchy, and thenceforward for over three centuries Denmark and Poland remained feudatories of Germany. Otto also made Bohemia tributary (950), and conquered the wild lands along the Elbe and the Oder and the shores of the Baltic, and planted missionaries there. It was he who, in 968, founded the archbishopric of Magdeburg.

In 951 Otto marched into Lombardy to protect Adelheid, widow of King Lothair, and as Eadgyth of England had been dead some years, he ended his chivalrous defence of Adelheid from the persecutions of King Berengar of Lombardy by marrying her, and by conquering the kingdom. He proclaimed himself King of Italy at Pavia (951), and reinstated Berengar as his vassal in the next year. But as the latter governed evilly the Pope complained to Otto, who deposed him in 961, and was in return crowned Emperor of the Holy Roman Empire by the Pope at Rome in 962. His three predecessors on the German throne had been neither kings of Italy nor emperors, but thenceforth both the Lombard and the imperial crowns were always claimed by the kings of Germany, and the title of emperor is that by which they are far more commonly known than that of king. The results of this constant connection with Italy were unfavourable to both countries. The German king, it is true, became the greatest prince in the mediæval world; holding rank above all kings, and also by this he elevated the position of the Germans and gave them union; but on the other hand Germany was involved in the nebulous web of Italian, and especially of papal politics, and wasted both treasure and power. During their residence in their own country, the emperors' fiefs in Italy waxed unruly and independent, and when the emperors were in Italy all went to ruin behind their back in Germany. Before his coronation as emperor, Otto thoroughly crushed the Hungarians, who were now pressing hard upon Germany, at a victory near Augsburg, in 955. The Hungarians ceased their constant inroads, and for centuries were nominally feudatories of the kings of Germany.

Otto favoured learning and the arts. In his reign Archbishop Bruno founded the famous school of Cologne; and the king's cousin, Hrotswitha, abbess of Gandersheim, wrote some Latin comedies in the style of Terence which have come down to us. At this time the language of all learning, literature, and diplomacy was Latin. The Roman-

esque style of architecture, sculpture, painting, and music were zealously cultivated in the service of the church. Otto, however, acknowledged no supremacy of the Pope; but very much on the contrary, he looked on the Pope as his chief minister. Accordingly, in 963, we find him at Rome deposing John XII., and ordering Leo VIII. to be elected; and when Rome revolted against the new sovereign he besieged it, conquered it, re-established Leo there, and carried off the antipope, Benedict V. (who had meanwhile been elected), to Germany, 964; two years later he had to suppress a revolt against the ensuing pope, John XIII. He married his son Otto by proxy to the Greek princess Theophanô, daughter of the Byzantine Emperor Romanos II., 968; but it was no less than four years before the princess arrived in Germany, having been carried off by Greeks on her way. Otto the Great spent his last years almost wholly in Italy, returning to Germany to die there in 973.

Otto II. (born 955) succeeded his father. He had already been crowned "co-emperor" in 967. His reign was an incessant struggle against the great dukes, no longer kept under by the strong hand of his father. He succeeded at length on every side, and by an invasion of France, during which the German army encamped on the heights of Montmartre, overlooking Paris, he forced the King Lothair to acknowledge that Lotharingia (Lorraine), which he had attempted to claim for France, was a part of Germany (980). He now felt free to pass into Italy, and recover his rapidly waning imperial rights, but was badly defeated in Calabria (982), and died next year at Rome (983). He had held a diet at Verona in 982, when his infant son Otto had been elected his successor.

Otto III., the "Wonder of the World," was born in 980. He derived his title from his literary accomplishments, due largely to his excellent tutor Gerbert, the profoundest scholar of the age, whom in grateful return he caused to be made pope as Sylvester II. The baby-king was crowned at Aix-la-Chapelle in 983, his mother Theophanô acting as regent. His great-uncle Henry of Bavaria for a time seized the boy's person, but the loyalty of the Archbishop of Mainz, and many of the other chief nobles, forced him to restore the king to his mother. This was a capable and firm princess, in whose hands the country was well ruled. When the young king was sixteen he was sent to Rome with an army to rectify matters in the papacy, and to be crowned. Gregory V., a grandson of Otto the Great, was made pope, and crowned Otto III. in return, in 996; but Otto had to return in 998 to restore Gregory to the throne whence he had been driven, and having entered Rome by arms and captured Crescentius the consul, who had appointed Philagathos pope, he beheaded him in 998. In 999 he appointed his revered tutor Gerbert pope as Sylvester II. A noteworthy incident is recorded of Otto III. in 1000, when holding a diet of the empire at Aix-la-Chapelle. He caused the tomb of Charles the Great to be opened, and the body of the great emperor was found excellently preserved, still clad in its imperial robes, and seated on a marble throne, just as when first entombed. A journey into Italy to withstand the inroads of the Saracens, though thoroughly successful, cost the emperor his life, for he was poisoned by Stephania, the widow of Crescentius, whom he had executed, and died in Campania in 1002. With him the line of the Saxon dynasty terminated.

Orro IV. (born 1175), one of the Welf family, was elected by his partisans as emperor in 1197, on the death of Henry VI., to the prejudice of the late emperor's son Frederick (afterwards Frederick II.). He was supported against rival claimants by the Pope, who crowned him emperor in 1209. He gave way to Frederick II. about 1214. He died in 1218.

OTTOMAN EMPIRE. See **TURKEY**.

OTTOMAN TURKS. See **TURKEY, TURKS**.

OTWAY, THOMAS, a celebrated and unfortunate English dramatist, was born 3rd March, 1652, at Trotton, in Sussex, of which his father, the Rev. Humphrey Otway (afterwards rector of Woolbeding) was then curate. He was educated at a school in Wickham, near Winchester, and in 1669 he was entered a commoner of Christ Church, Oxford. In 1671 he appeared at the Duke's Theatre, London, in the "Forced Marriage," a new play by Mrs. Aphra Behn, but "the full house put him to such a sweat and tremendous agony, he being dash't, spoil'd him for an actor." He refused to take orders, and quitting the university in 1674 he obtained a cornetcy in a troop of horse. The military life, however, proved un congenial to his tastes, and within a year he had sold his commission and moved to London, where he sought to earn a livelihood by his pen. In 1675 his "Alcibiades," an indifferent play, was performed at the Duke's Theatre, where it met with a cold reception, but his "Don Carlos," which was performed the following year, was warmly patronized by Lord Rochester, and became a genuine success. In 1677 he published "Berenice," a translation from Racine, and the "Gleats of Scapin," a translation from Molière; a dull and indecent comedy of his own, entitled "Friendship in Fashion," appearing in 1678. Otway then served as an officer in the army, taking part in the unfortunate expedition to Flanders, but soon resigned his commission and returned to London and the stage. In "The Soldier's Fortune," which appeared in 1679, he endeavoured to turn his military experience to account, and the following year he produced "The Orphan," one of the best of his plays, together with "The History and Fall of Caius Marius," an acknowledged plagiarism from "Romeo and Juliet." In 1682 appeared the finest of all his dramatic efforts, "Venice Preserved," the success of which was decisive. The author, however, derived but small pecuniary benefit from it, and from this time till his death he suffered extremely from poverty and neglect. From some of his letters it appears that he was also the victim of a hopeless passion for Miss Barry, a beautiful actress, the principal female performer in his plays. Giving way to dissipation, he produced but one more play, "The Atheist," a second part of "The Soldier's Fortune," in 1681. He died at a public-house on Tower Hill, 14th April, 1685, at the early age of thirty-four. According to Johnson's account Otway's death was a sad one. He had been hunted by bailiffs until he sought refuge in an obscure public-house, where he became utterly penniless, and after a long fast was choked by the first mouthful of a roll he had purchased with a guinea given him in charity. Another account ascribes his death to a fever caused by his irregular habits, while a third narrative is to the effect that the fever was caused by his hurried pursuit of a criminal who had murdered one of his intimate friends, and whom he followed to Dover.

As an author Otway produced much that was dull and uninteresting, and in everything but pathos he is mediocre. In the delineation of the latter, however, he is unrivalled, and it is to his power in this respect that he is indebted for his position in English literature. Dryden admitted that Otway had a power of moving the passions of his audience which he himself did not possess, and Sir Walter Scott, in his "Essay on the Drama," declares, "The talents of Otway in his scenes of passionate affection rival at least, and sometimes excel, those of Shakspeare." The best edition of Otway's works is that of Thornton (three vols., 1813). (For accounts of his life see Johnson's "Lives of the Poets;" Gosse, "Seventeenth Century Studies;" and Ward, "History of English Dramatic Literature," vol. ii.)

OUDE NAR DE, a town of Belgium, in the province of East Flanders, 15 miles S.S.W. of Ghent, on the Scheldt, where Marlborough and Eugene defeated the French, 11th July, 1708. An old church and the town-hall are of interest.

OUDEH, a province of British India, is situated in the middle valley of the Ganges, which river forms its southern boundary; on the east and west it is inclosed by the older acquired districts of the North-western Provinces, with Jannpur, Basti, and Azamgarh on one side, and Shahjahanpur, Farukhabad, and Cawnpore on the other; on the north the boundary, partly natural and partly artificial, marches with that of the independent kingdom of Nepal. Its greatest length from north west to south-east is 234 miles, and its breadth 150 miles. Oudh lies between 25° 34' and 29° 6' N. lat., and 79° 45' and 83° 11' E. lon. The total area of the province is 23,954 square miles, of which 13,126 square miles are cultivated with crops; 952 square miles are covered with orchards of mango and mohwa trees; 1134 square miles, or about 6½ per cent. of the total area, are covered with lakes, ponds, and rivers; 1612 square miles, or about 7 per cent., are barren waste; 825 square miles are government forests, and 5554 square miles, or about 22 per cent. of the whole, are arable waste. The total population is 11,500,000, or 480 to the square mile—probably the densest of any similar area anywhere.

The general surface of the country is a plain sloping from north-west to south-east, varied here and there with almost imperceptible undulations, the highest part of the country being the high land north of Dudwah Ghat in Khairagarh, which is 600 feet above sea-level, while the lowest point, on the border of the Jannpur district, is 230 feet. The first or lower chain of the Himalayas, which bounds the province on the north-east along the Gonda district, is from 2500 to 1000 feet in height. This chain is one of four parallel ranges running through Nepal, each loftier and more remote, one rising a little above the other, all of which are distinctly visible in the rains from Fyzabad and Sitapur, a distance of nearly 200 miles. The main rivers are the Ganges, which runs along its southern boundary, the Gunti, the Sarda, the Kauriala and Gogra, the Ramganga, the Sai, and the Rapti. Their aggregate dry weather discharge is 18,800 cubic feet per second, and the entire river discharge reaches 20,000 cubic feet, or half the quantity of the five rivers of the Punjab; their channels lie on an average from 20 to 50 feet below the level of the country. The rivers of the province afford about 1350 miles of navigable stream. Numerous *phils* or marshes exist, only two of which, however, can be dignified with the name of lakes, viz. Behti in district Partalgarh, and Sandi in district Hardoi. The forests of Oudh lie principally in the districts of Kheri, Bahraich, and Gonda on the north. The Oudh and Rohilkhand Railway runs through the entire length of the province, connecting with the East Indian Railway at Benares, Cawnpore, and Aligarh.

Oudh is a tropical country, a little smaller than Scotland, and somewhat larger than Denmark, but with a population more than double that of both countries put together. The country along the northern frontier is thinly populated.

Though the climate is subject to extremes of temperature, sometimes rising to 112° in the summer and sinking to 35° in the winter, it may be briefly described as a mean between that of the Punjab and North-western Provinces, and that of Bengal; for while the cold is not so great, nor the dry heats so intense as in the former, the difference in the seasons is far more marked than in the lower provinces of Bengal, with their moiister though more equable temperature. Its three seasons, the cold, the hot, and the rainy, are well defined, the first extending from early in October to the end of March, the second following, and the third commencing with fair regularity in the middle of June and lasting to the middle of October. To a European the climate of Oudh during the short, cold season seems nearly perfect. The plains are subject to hot sultry winds from the west and occasional fierce hurricanes.

A large amount of wheat and other edible grains is produced in and exported from Oudh; sugar, tobacco, sulphure, and oil-seeds are also produced and exported in considerable quantities. Some of the Oudh rice and tobacco are of superior quality. The population being essentially agricultural, the province can boast of no manufactures worth mentioning. Except minute particles of gold, which are washed down by the hill torrents in quantities too infinitesimal to repay their collection, valuable minerals are not known to exist. Kankar, or carbonate of lime, exists all over the province, and is used for the production of lime for building and for roads.

For administrative purposes the province is divided into four divisions, each controlled by a commissioner, and subordinate to commissioners are twelve deputy commissioners, each holding executive charge of a district. In every district there are three or more subdivisions, the direct management of each being intrusted to a native sub-collector or *tahsildar*. The chief town is Lucknow.

Before 1855 the chronic anarchy and oppression had reduced the people of Oudh to extreme misery. Reform by its native ruler had long been hopeless. The only remaining remedy was deemed to be annexation, with a liberal provision for the reigning house. A treaty was proposed to the king in 1856, which provided that the sole civil and military government of Oudh should be vested in the British government for ever; that the title of King of Oudh should be continued to his majesty and the lawful heirs male of his body; that the king should be treated with all due attention, respect, and honour, and should have exclusive jurisdiction within the palace at Lucknow and the Dilkusha and Bibipur parks, except as to the infliction of capital punishment; that the king, Wajid Ali Shah, should receive twelve lakhs a year for the support of his dignity and honour, besides a sum of three lakhs for palace-guards; that his successors should receive twelve lakhs a year; and that his collateral relations should be maintained separately by the British government. The king was allowed three days to consider and sign the treaty. He refused to sign it, and therefore, in February, 1856, the British government assumed to itself the government of Oudh, exclusively and for ever. A provision of twelve lakhs a year was offered to the king, which he accepted in October, 1859.

On 13th February, 1856, the country became an integral part of the British territory. Oudh was immediately constituted into a chief commissionership, and organized on the ordinary British model. Early in the succeeding year the discontent in the province burst into open rebellion as soon as the mutiny at Meerut gave the signal for a general rising. In March, 1857, Sir Henry Lawrence had assumed the administration at Lucknow; and on the 30th of May, five of the native regiments broke into mutiny. The remainder of the events connected with the siege and recovery of the capital have been narrated in the article on Lucknow. A general revolt throughout the whole of Oudh followed upon the defection of the native troops; and by the middle of June the entire province, save only the Residency at Lucknow, was in the hands of the rebels. On 4th July, Sir Henry Lawrence died from wounds caused by a shell. For twelve weeks the little garrison was besieged by an overwhelming body of mutineers, till relieved by Outram and Havelock on the 25th of September. In spite of this reinforcement, the British force found itself too weak to fall back upon Cawnpore, and underwent another siege, till again relieved by Sir Colin Campbell on the 17th of November. The women and children were then escorted to Cawnpore by the main body, while General Outram held the outlying post of the Alambagh with a small garrison. Lucknow itself remained in the hands of the rebels, who fortified it carefully under the direction of the Begam of Oudh. Early in 1858 General Franks

organized an army at Benares for the reconquest of the province, and cleared the south-eastern districts of rebels. At the same time Jang Bahadur, regent of Nepal, came to the aid of the English with a body of 9000 Gurkhas, and twice defeated the insurgents with great slaughter. On the last day of February Sir Colin Campbell crossed the Ganges and marched on Lucknow. Occupying the Dilkusha Palace on 5th March, he effected a junction with Franks and the Nepalese army, and began the siege the next day. The town was captured after a desperate resistance, and the work of reorganization of the province was rapidly pushed forward. It included a new arrangement with the *talukdars* or great feudal landowners, whose title acquired a fresh basis, while their appointment as honorary magistrates soothed their pride.

Since the pacification in 1858, the province has been administered without further vicissitudes. The opening of railways has afforded fresh outlets for its agricultural wealth; the institution of courts of justice, practically unknown under the Mussulman kings, has given unwon security to life and property; and the spread of education has done much to develop the naturally keen intellect of the people. On the 17th of January, 1877, Oudh was partially amalgamated with the North-western Provinces by the unification of the two offices of chief-commissioner and lieutenant-governor. Nevertheless the country remains for most administrative purposes a separate province.

OU DINOT, CHARLES NICHOLAS, Duc de Reggio and Marshal of France, one of the bravest and most successful of Napoleon's generals, was born 25th April, 1767, at Bar-sur-Ornain. In 1781 he was simply a private soldier in the Medai infantry; and after passing through the various grades of military rank during the heat of the French Revolution, he became in 1798 a general of division. His services in the field were of the most varied character, and duly appreciated by his illustrious commander. They comprehended the Meuse, the Rhine, the Moselle, Italy, Germany, Sweden, and Holland. Everywhere he fearlessly exposed himself, and his wounds were countless. He received a contusion in the head at Hogueuean; was struck on the leg at Trèves; had a ball in the thigh and three sabre-wounds on his arm and his neck at Neuberg; was wounded in the breast at Vrenelos; was hit by a ball at Schwytz; and received a bullet in his side at the Beresina. Napoleon created him a marshal in July, 1809, and Duc de Reggio in 1810. Joining the Bourbons after the Restoration, he became a major-general of the royal guard, and commanded the first corps of the army of the Pyrenees in 1823. After the revolution of 1830 he lost his employment. He died 13th September, 1847.

OUGHTRIED, WILLIAM, was born at Eton, in Buckinghamshire, in 1573. He was educated at Eton, and was elected thence, in 1592, to King's College, Cambridge. While he was an undergraduate he invented an easy method of geometrical dialling, but which was not given to the public before the year 1647. In the year 1603, or thereabouts, Oughtred was ordained priest and presented to the rectory of Albury, near Guildford, in Surrey. At the age of eighty, if we may believe Mr. Collier, he died in an ecstasy of joy upon hearing of the restoration of Charles II. Oughtred was one of the first among the English mathematicians of his day. He was the inventor of the sliding rule.

OUNCE (*Felis uncia*) is a species of the Cat family (FELIDÆ). The ounce or snow leopard, as it is sometimes called, nearly resembles the LEOPARD in size, appearance, and habits, but differs by having longer and shaggy hair and a longer tail. The general colour is whitish-gray, spotted like the leopard, but less distinctly. The ounce inhabits the mountainous regions of Asia, and is found in the Himalayas at a great elevation. It preys upon sheep, goats, &c., but has never been known to attack man. The name ounce is sometimes applied to the jaguar (*Felis onca*).

OURANOS (Sanskrit *Varuna*, Lat. *Uranus*), the primeval god of the sky or air, in the earliest formless dynasty of the Greek mythology, was the spirit or embodiment of the heaven, consort and brother of the spirit or embodiment of the earth, Gaia. Their many children lay close pressed by the enfolding sky-god against the swelling bosom of the earth-goddess, and to free themselves they conspired against their parent. Ouranos imprisoned them all in Tartaros, whereupon mother Earth, enraged, gave her son Kronos a sickle of adamant, with which he succeeded in mutilating his father and in thrusting asunder the heaven and the earth. The older god, weak and useless, gave way before the new dynasty of Titans headed by Kronos, which in its turn was to be superseded by the Olympians, of whom Zeus was the chief.

The children of Ouranos and Gaia were the six pairs of Titans, Kronos and Rhea, Okeanos and Tethys, Hyperion and Theia, Koios and Phoebe, Iapetos and Themis, Kreios and Mnemosyne the three Kiklopes (Cyclops), and three 100-handed giants. From the drops of blood which fell from Ouranos on earth, through the crime of Kronos, rose the Furies and the twenty-four giants. From the foam which rose in the sea as the god's mutilated body fell into it sprang Aphrodite, according to some accounts of her birth. The planet URANUS is treated of under that title.

OURA'RI, also called Wourali or Urari, the deadly poison with which the natives of Guiana envenom their arrows. The basis of it is obtained from the juice of *Strychnos toxicaria*.

OUSE, a name borne by several rivers of England, derived from the Cymric *uysg*, water. The largest is the Great Ouse, rising in the south-west part of the county of Northampton. It flows east, north-east, and north, with a very tortuous course, through the counties of Bucks, Bedford, Huntingdon, Cambridge, and Norfolk, and past the towns of Buckingham, Bedford, Huntingdon, and Ely, and falls into the south-east corner of the Wash, at Lynn-Regis. The chief tributaries are—the Ivel, Cam, Lark, Little Ouse (forming the boundary between Norfolk and Suffolk), Stoke, and Nar. It has a length of 160 miles, for more than 100 of which it is navigable; area of basin, 2800 square miles.

A river of Yorkshire, formed by the confluence of the Swale and Ure, is also known as the Ouse. It flows S.E., receiving the Nidd, Wharfe, Derwent, Aire, and Don, and unites with the Trent to form the estuary of the Humber; length, 60 miles, for 45 of which (to York) it is navigable. The Ouse of Sussex is about 30 miles in length, flowing south-east and south, past Lewes, into the English Channel at Newhaven.

OUTCROP, a term employed in geology. When strata are inclined, their denuded edges exposed at the surface are technically referred to as their "outcrop" or "basset."

OUTER HOUSE. See **COURTS**.

OUTLAWRY. This term, which is derived from the Saxon *utlugh* or *utlughh*, signifies an exclusion from the benefits and protection of the law. In English law it was formerly a punishment consequent upon a flight from justice or a contumacious neglect or refusal to appear and answer for a civil or criminal transgression in obedience to the process of a court of competent jurisdiction. It was formally abolished by 42 & 43 Vict. c. 59 in civil proceedings, but specially retained in criminal proceedings by 33 & 34 Vict. c. 23. Even in the latter, however, it has become practically obsolete. In Scotland outlawry or fugitation may be pronounced by the supreme criminal court in the absence of the panel on the day of the trial.

OUTLIERS, in geology, are isolated portions of a formation which have been separated from the main mass by denuding agencies.

OU'TRAM, SIR JAMES, G.C.B., was the son of an eminent civil engineer, Benjamin Outram, Esq., of Butterley Hall, Derbyshire, where he was born in 1808. He was educated at Marischal College, Aberdeen, went to India as a cadet in 1819, and after being lieutenant and adjutant of the 23rd Bombay Native Infantry, he commanded, organized, and disciplined the Mhel corps. After the capture of Cabul, he attracted the admiration of India by his daring pursuit of the fugitive Dost Mohanmed. He was British resident at Hyderabad when the war of 1843 against the Ameers of Sind broke out, and he distinguished himself in the contest, although opposed to the annexation of Sind which followed it. He succeeded Sir Henry Sleeman as resident at Lucknow, and on the annexation of Oudh was appointed chief-commissioner, but ill-health compelled him to leave for England. In 1856, when claudication was to be inflicted on Persia, Outram was appointed, with political powers, to the chief command of the expedition, which under his conduct soon forced the Shah into submission. He then returned to India. Soon afterwards the Indian Mutiny broke out, and Havelock, in the midst of his heroic struggle to reach and relieve Lucknow, found himself superseded by the appointment of Outram to the military command of the united Dinapore and Cawnpore divisions. With great delicacy and generosity, Outram declined to assume the military authority thus conferred upon him, at least until Lucknow should be relieved, and accompanied Havelock as a volunteer in the final and victorious march to Lucknow. He then took the command, but only to be in turn besieged, and he held the Alumbagh against almost overwhelming forces, until Lord Clyde advanced to his relief. He was afterwards made chief-commissioner of Oudh, created a baronet, promoted to the rank of lieutenant-general in 1858, and in 1860 received a vote of thanks passed by the British Parliament. He took his seat as a member of the supreme council of India, in Calcutta, but ill-health obliged him to return to England. The winter of 1861 he spent in Egypt, and after a short residence in the south of France died at Paris, 11th March, 1863. He was buried in Westminster Abbey, the marble slab on his grave bearing as his epitaph the significant phrase applied to Outram by Sir Charles Napier, "The Bayard of India." Sir James was the author of "Rough Notes on the Campaigns in Sind and Afghanistan in 1838," and of "Our Indian Army," in which he exposed the amalgamation of the native and European forces. His name will ever be distinguished as one of the most gallant of our Indian heroes. ("James Outram: a Biography," by Major-General Sir F. J. Goldsmid, G.B., London, 1880.)

OUTRIGGER is a strong beam fixed on the side of a ship and projecting from it, in order to secure the masts in the operation of careening, by counteracting the strain it suffers from the movement of the careening tackle; also a boom used in the tops to thrust out the breast backstays to windward, to increase the angle of tension and give additional security to the topmast. It now more commonly means a frame for carrying the rowlock at some little distance beyond the side of a boat, instead of being out in the side of the boat itself. Such outriggers are now always used for narrow boats, as racing boats, &c., to the enormous increase of the leverage in rowing.

OUIVRAN'DRA (Malagasy, *ouri*, yam, and *rans*, water), a genus of aquatic plants, whose finest species abounds in the warm streams of Madagascar. One of these (*Ouvirandra fenestralis*) is known as the *lattice-leaf* or *lace-leaf*, in allusion to the open web or reticulation of veins of which the leaf consists. It is valuable to the natives, as the large fleshy roots contain an abundance of starch, which is used for food. Ouvirandra is included by Bentham and Hooker in the genus *Aponogeton*, belonging to the order **NAIADACEÆ**.

OU'ZEL or **OUSEL** was the name applied by our early writers to the **BLACKBIRD**, as by Shakspeare in the "Midsummer Night's Dream":—

"The ouzel cock, so black of hue,
With orange-tawny bill."

It also forms part of the name of the **WATER OUSEL** or **Dipper** (*Cinclus aquaticus*).

OVAL, or as the name imports, egg-shaped, is the name given originally to such a form as the section of an egg presents, round, but not circular nor elliptical. In mathematics it has received some extension of meaning. Any curve, or isolated branch of a curve, which returns into itself, other than a circle or an ellipse, would be called an oval.

Ovary. The part of the flower which bears the seeds consists of one or more metamorphosed leaves called carpellary leaves, or simply carpels. The limb of the leaf inclosing the young seeds (ovules) is called the *ovary*, and its mid rib is generally lengthened into the *style*. The margins are folded in, so as to join and form on the interior the placenta, on which are placed the ovules. These may be arranged in lines down the margins, corresponding to the teeth or lobes of a leaf, e.g. the peas in a pod; or they may be numerous on an extended placental surface, as in Orchideæ: these are cases of marginal placentation. On the other hand, they may cover the whole internal surface, springing from the nerves of the limb of the carpellary leaf, as in Nymphæacæ; or they may even be borne only on the midrib, as in Cactacææ. The line of union of the margins is called the *ventral suture*, while the midrib is known as the *dorsal suture*. In **Gymnosperms** they are situated on the margin or surface of open expanded carpels.

The ovaries are sometimes in a whorl; sometimes there is an indefinite number of them arranged in a spiral, as in the buttercup. It is evident that the juxtaposition of the carpels favours their cohesion in growth, and when this takes place the pistil is *syncarpous*; if the carpels remain distinct, as in the buttercup, the pistil is *apocarpous*. If the ovaries adhere to the calyx, they are said to be *inferior*; if not, *superior*.

OVA'TION was an inferior triumph allowed by the Romans to those of their generals whose victories were considerable, but not of the transcendent importance to demand a triumph. A sheep (Lat. *ovis*) was offered by the general instead of a bull, he entered the city on foot in the simple *toga prætexta* of high officer, he was crowned with myrtle and laurel, and heralded by flute-players only. The word has passed into modern English in an altered sense. "He received quite an ovation" only means that he was greeted with considerable enthusiasm.

OVEN-BIRD (*Furnarius rufus*) is a Passerine bird belonging to the family of Tree-creepers (Dendrocolaptidæ), so called from the nature of its nest. The oven-bird is about 8 inches in length, and has the whole upper part of the body of a reddish-brown colour, and the lower surface white, with the flanks reddish-brown. It builds its nest always in an exposed situation, such as a naked branch, the palisades of a garden, or the windows of a house, forming it of earth, in the shape of a small oven. The nest is hemispherical in its form, and about 6½ inches in diameter; both sexes engage in its construction by bringing small pellets of clay, straw, and grass-stems, and working them into the edifice, which becomes hard and firm by the heat of the sun. The opening is on one side, and the interior is divided by a partition into two chambers, in the inner of which the eggs, four or five in number, are deposited. These nests are made use of for several successive years. This species, which occurs in the countries of La Plata, feeds like its allies upon insects, which it captures both on trees and on the ground. It is a gay and sprightly bird, perching and running with great agility.

OVER DAR'WEN, a market-town and municipal borough of England, in the county of Lancaster, situated 210 miles from London. The town has rapidly grown to its present proportions, owing to its water facilities and the proximity of coal. It has a free library and public baths, and a fine market house and municipal offices, opened in 1882, and various churches and chapels of more or less architectural pretensions. Cotton-spinning is carried on extensively, and some of the mills are not only large, but handsome buildings. Print, dye, bleaching, and machine works, iron and brass foundries, rope factories, collieries, and stone quarries, also furnish employment. The population in 1881 was 29,741.

OVERBECK, FRIEDRICH (1789–1869), the founder of a school of painters with very definite if limited aims, in Germany—attempts to work out a national art instead of copying Italian models—was a native of Lübeck. He studied his art in Vienna; but eventually in 1809 he reached Rome, where he was joined by Cornelius (whom Mendelssohn has celebrated musically) and by Schadow. His chief works are in fresco, and the finest are those in Santa Maria degli Angeli at Assisi, and the five scenes from Tasso's "Jerusalem Delivered," in the Villa Massimi, Rome. His great oil picture, familiar from the engraving of it, on the "Influence of Religion on Art," is in the Stadel Institute at Frankfurt, and the "Entrance of Christ into Jerusalem" is in the Marienkirche at Lübeck. Overbeck's studies in line and designs for engraving admirably suit his peculiar hard manner. His great aim was to overthrow the influence of Greece and of the Italian renaissance, and to work on the lines of the pre-Raphaelite Italians and of Dürer and the Germans. Though he founded the school which is often called the School of Düsseldorf, Overbeck himself always remained at Rome. He died there in 1869. The best known of his immediate disciples are Philipp Veit (1793–1877) and Joseph Föhrieh (1800–76).

OVERBLOWING, OVERSTRINGING, technical musical terms of frequent occurrence. The first applies to an organ or other pipe, which by increased pressure of wind is made to speak at the first or second harmonic, instead of at the prime tone. The second describes a method of stringing iron-framed pianofortes, part of the strings running from left to right diagonally, and part from right to left diagonally, at a slightly higher or lower level. Sometimes three and sometimes even four crossings are made. One object of overstringing is to gain the increased length of the diagonal line. See **PRAXINOPIRE**.

OVERBURY, SIR THOMAS, an English author and comiter, the circumstances of whose death give a peculiar interest to his history, was the son of Nicholas Overbury, a Gloucestershire squire, and was born at Compton Scorton, Warwickshire, in 1581. He was educated at Queen's College, Oxford, where he took the degree of B.A. in 1598. He afterwards spent two or three years in foreign travel, from which he returned master of several languages and with the reputation of being an accomplished gentleman. In 1601 he paid a visit to Scotland, and while there formed an intimacy with Robert Carr, a handsome, ambitious, and unscrupulous man, who was then page to the Earl of Dunbar. Carr followed his friend to London, and on the accession of James to the English throne he became one of the royal favourites, was created Viscount Rochester, and in 1608 obtained knighthood for Overbury and a Welsh judgeship for his father. Carr, who was grossly illiterate, seems to have relied greatly upon Overbury, who placed his scholarship and wit at the disposal of his patron, being in his turn flattered and caressed by all who were anxious to gain the favour of the minion and of his royal master. But the friendship between Rochester and his learned but unprincipled mentor was soon fatally dissolved. Rochester had formed a guilty attachment to the beautiful but utterly abandoned Countess of Essex, and

had been aided in his suit by Overbury, who composed passionate letters and amorous lays for him, by which and the charms of his person he succeeded in inspiring the lady with a passion for himself. When, however, he informed Overbury that he intended to obtain a divorce for the countess from her husband, and then to marry her, Overbury dissuaded him from this step and denounced the lady's character in strong but well-merited terms. Rochester, incensed at such advice, imparted to the countess what Overbury had said about her, and she became furious for revenge. After unsuccessfully endeavouring to procure his assassination, she prevailed upon her lover to assist in her schemes for his destruction, and Rochester, aided by the Earl of Northumberland, so managed matters that Overbury was arrested on a trivial charge and confined in the Tower, 21st April, 1613. Here he was kept in close confinement, his friends being debarred from seeing him, and his sole attendant being a man named Weston, who had been bribed to poison him. By the aid of this ruffian slow poisons were regularly administered to the unconscious prisoner, his daily food and even the water which he drank being tainted with deadly powders. For some months his strong constitution resisted the effects of the poison, but at length, worn to a skeleton and covered with sores, he died 15th September, 1613. His body was hastily and secretly buried within the walls of the Tower, and it was given out that he had died of an infectious and loathsome disease. Rochester, now created Earl of Somerset, and his paramour were married with great pomp on 26th December, 1613, and the affair of the death of Overbury was soon apparently forgotten. When, however, George Villiers had supplanted the earl in the royal favour he caused an inquiry to be instituted in order to dispose effectually of all rivalry, and then the whole plot came to light. The murderers were put upon their trial and condemned, but while four of the inferior agents suffered the penalty of the law Somerset and his wife were pardoned by the king and merely ordered to be banished from the court. The reason for this extraordinary clemency on the part of the king is generally ascribed to his fear that Somerset, who had been a pander to the royal vices, would, if driven to bay, have made some undesirable disclosures. Overbury's works, which were not published until after his death, consist of the poems entitled "The Wife" (1614); "The First and Second Part of the Remedy for Love" (1620), a paraphrase from Ovid; and the prose works, "Characters" (1614); "News from Anywhere, or Old Truths under a Supposed Novelty"; "Observations on the Seventeen Provinces" (1626); "Crums fallen from King James' Table, or his Table Talk" (1715). Of the whole the best is the "Characters," which are well drawn and full of point. A collected edition of Overbury's works, with a life by E. F. Rimbault, was published in 1856.

OVERLAND ROUTE TO INDIA. Before the opening of the Suez Canal, this route was generally chosen by those travellers who wished to reach India quickly. It lay *via* Alexandria, to which port the traveller either proceeded direct from Southampton or through France, and thence *via* Marseilles. From Alexandria passengers went by rail to Suez, and were thence conveyed to Calcutta in twenty nine, to Bombay in thirteen, and to Madras in twenty four days, by the Peninsular and Oriental Steam Navigation Company. A steamer going round the Cape of Good Hope from London to Calcutta usually took ninety-four days, and a sailing vessel four months. By the overland route the same port was reached in forty days. The opening of the ship canal through the Isthmus of Suez has, of course, rendered the overland journey across it unnecessary, and the usual route for well-to-do passengers and all the mails to India, China, and Australia now, is through the Mont Cenis Tunnel to Brindisi, in Italy, and thence to Alexandria, and through the canal to Suez.

OVERLAP, in geology, the extension of an overlying series of strata beyond the limits of the immediately subjacent beds. This phenomenon obviously indicates an increase in the area of deposition, and thus, in most cases, a depression of the bed of the water in which the sediment was accumulating. Examples are everywhere numerous, and the overlapping of the coal measures of South Wales over the underlying carboniferous beds may be cited as one of the most typical. The term *overstep* has been suggested to indicate the extension of a superjacent stratum over the successive outcrops of a series of older inclined beds.

OVERSEERS are officers annually appointed on the 25th March, or within fourteen days afterwards, to determine the poor-rate in parishes of England and Wales, and to collect and use it in giving relief to the poor. Peers, members of Parliament, magistrates, ministers, doctors, military and naval officers, and officers of the customs and excise, are exempt from serving the office of overseer, and no one who is directly or indirectly concerned in any contract to supply goods to the workhouse, or for the use of the poor, may be appointed to the office. Overseers must be resident householders paying the poor assessment, and substantial and trustworthy persons, and they are appointed by two or more county justices, or two or more city or borough justices, the appointment being now regulated by 12 & 13 Viet. c. 8 and 103, and 15 & 16 Viet. c. 38. Before the passing of the Poor Law Amendment Act it was the business of an overseer to appropriate and distribute, as well as make out and collect the poor-rates; but by this Act his duties, so far as they related to ascertaining fit objects for parochial relief, the amount to be given them, and the manner of giving it, were transferred to a board of guardians, although he may still give relief in articles (not in money) in case of sudden or urgent necessity. The chief duties of overseers at present are to make poor-rates and see that they are properly collected; to attend to the settlements of paupers; to keep the rate-books and valuation lists of the parish (which must be open to the inspection of all rated inhabitants); to make out the list of persons in the parish liable to serve on juries; and especially to make out the list of the persons entitled to vote for members of Parliament. The duties of an overseer and of an assistant-overseer are identical, but the latter is a paid officer, appointed where, on account of the population, the extent of the parish, or other difficulties, the services are onerous and troublesome. Assistant-overseers to take the duties of five or six townships, are also appointed by the commissioners under the Poor Law Act.

OVERTONES, a term used by Professor Tyndall for the more correct acoustical term **PARTIAL TONES**.

OVERTURE, an "opening-symphony" (Ital. *ouverture*), such as that introducing an opera, an oratorio, or a play. It is usually entirely instrumental, but voices are occasionally introduced, as, for instance, in Gounod's overture to his opera of "Romeo and Juliet." It is also now very common to write an overture which is independent of any large work, and to style such a composition a concert-overture. Examples of this are Mendelssohn's "Hebrides," "Meerestille," and "Melusine;" Sterndale Bennett's "Parisina," "The Naiads," and "Paradise and the Peri;" Schumann's "Bride of Messina," &c.; Berlioz's "Les Francs Juges" (the Holy Vehm); Sullivan's "In Memoriam," and "Overture di Ballo," and many others. Beethoven's overture "Die Weihe des Hauses" (the Dedication of the House, i.e. the theatre), though not the opening movement of a musical work, opened the Josephstadt Theatre, and so justified its title.

But these concert-overtures all follow exactly the same musical form as the overtures proper, and are in no way to be distinguished from them, since they embody as distinct an idea (or should do) as do the preludes intended to pre-

pare the mind for the coming tragic or comic events of the stage, or the sublimities of religious emotion.

The oldest definite form of overture replacing the short prelude which had been used previously is that of Lully (the French style), beginning with a slow stately movement, then passing to a fugued allegro with much "development;" this was often separated from the final minuet or other dance-like movement by a few bars of pathetic adagio in a free cantabile style. Puccini and Handel followed this model invariably, and improved upon it, Handel's treatment being the most familiar and particularly happy.

Scarlatti's overture (the Italian style), differed from the French model. It had three movements: the first and third quick, the middle slow and in strong contrast. This form prepared the way for the kindred general plan of the symphony, and as *sinfonia* was the often-used Italian equivalent for "overture," it may be said to give it its name also.

The modern overture is much more varied in form. Mozart's influence overturned the stiff forms of his predecessors. His overture to the "Zauberflöte" is a splendidly brilliant and vivacious fugal, for the most part in strict form, at other times he prefers a free fantasia. In a general way the overture, when not rhapsodical, now follows the lines of the first movement of a symphony, often called "Sonata-form." The overture culminated in the hands of Beethoven, and the third overture which he wrote to "Leonora," his only opera. This stupendous work was felt to be too complete an opera in itself to serve as a prelude, and the fourth overture was then written by the indefatigable composer, which is known by the altered title of the opera, "Fidelio." It is curious to notice how in his most effective overture, the really great work introducing "Guillaume Tell," Rossini follows the line of Scarlatti, the three divisions being quite clearly traceable through all the artificialities of the Rossinian idiom. He even goes further back for his model, and concludes with a splendid burst of gay dance-music, as Lully and Handel of old. While carried away with the irresistible rush of that unrivalled "galop," one does not pause to consider the intense absurdity of coupling such a movement with the name of the legendary hero to whom Switzerland loves to ascribe her liberties; none the less, like all the rest of Rossini's earnest work (the "Stabat Mater" included), it is in flagrantly bad taste, delightful as it may be in itself, and grateful as we should be for the possession of it. The long crescendo in which one passage is repeated over and over again, with added instruments at each repetition, till the whole force of the orchestra comes down in one great final crash, is too well-known and characteristic a feature of the Rossinian overture to need more than mention.

The acme of romantic effect has, on the other hand, been gained by Weber in the overtures to "Der Freischütz" and "Oberon," and by Wagner in the overture to "Tannhäuser," and the heavenly prelude to "Lohengrin," and the palm of grace must be awarded to Mendelssohn's masterpiece, the overture to "A Midsummer Night's Dream," a wonderful creation, rivalling that of Shakespeare himself in its fairy-like delicacy and fancifulness.

OVERTURE. In the language of Scottish ecclesiastical law this term is applied to every proposal to bring any measure within the cognizance of the General Assembly, either in its legislative or executive functions.

OVID (*Publius Ovidius Naso*), the greatest amatory poet of the Romans, was born at Sulmo, in the country of the Peligni, B.C. 43, the same year in which Cicero was murdered. Ovid was of noble family. From his boyhood he was fond of writing verses, but his father discouraged his poetic aspirations on the ground that poverty was the condition of poets, and the youth accordingly tried to prepare himself for the career of the bar. On attaining the suit-

able age Ovid discharged the office of one of the *Triumviri*. He also acted as one of the court of the *Centumviri*, and on several occasions as a *judex*. But poetry was his delight, and he resolved to dedicate himself to it. He accordingly sought the society of the contemporary bards whose names he has himself recorded. He was acquainted with Maecius, Propertius, Ponticus, Bassus, and Horace (who was about twenty-two years older than himself), and spent an easy life at Rome in the enjoyment of their society. As a young man he had travelled much, and, indeed, completed his education at Athens. He was one of the most polished men of the age, and did not scruple to use his great powers of fascination freely. He was intimately acquainted with the family of Augustus, and probably possessed the emperor's favour; but at the close of the year A.D. 9 he was, most unexpectedly to himself, banished from Rome, and sent to reside at Tomi, near the coast of the Euxine. Before his banishment he had written his three books of "Amores," his "Heroides," and his three books "Artes Amatorie." The poet's exile was for life; and all his abject flattery of the emperor and his perpetual lamentations could not procure a revocation of his sentence. Its causes have been a subject of much literary discussion. He distinctly mentions his amatory poetry as one of them; but there was another fault (error) which he does not indicate ("Tristia," ii. 207). It is almost certain, from hints in his own poems as to his mistress "Corinna," that this was an intrigue with the profligate Julia, the great emperor's daughter. Julia was banished for her evil conduct in the year 2 B.C., but very possibly Ovid had managed to conceal his own share in her misdeeds till some chance brought it to the emperor's knowledge. During his exile he wrote the five books of his "Tristia," and the four books of the "Letters from Pontus." The latter are addressed to his wife in a most affectionate strain, and to some of his friends. The fifteen books of the "Metamorphoses" were unfinished when he was banished, and it is said that the poet burned his own copy; but there were other copies in existence. The twelve books of the "Fasti," of which the first six only are now extant, were completed during his exile. Ovid died at Tomi, A.D. 18, in the sixtieth year of his age and the tenth of his banishment.

His poems are one of the most valuable parts of Roman literature. The fertility of his invention, his pure taste, his excellent judgment, and the ease of his versification place him in the first rank. He had an eye for rural beauties, and his brief descriptions of natural scenery can hardly be surpassed for fidelity and pictorial effect. The character of some of his amatory poetry, however, is without excuse, except that the age was licentious and the poet went with his time. His good taste keeps him free from obscenity, but his voluptuous colouring is more seductive and more corrupting than the occasional coarseness of Horace. The character of the man appears to have been humane, generous, and affectionate; his range of thought was wide and lofty, and numerous passages show his exalted and noble aspirations. He wrote one tragedy at least, the "Medea," which is highly commended by Quintilian; and various minor poems are attributed to him, some perhaps without much foundation.

The latest real addition to Ovidian literature is a most scholarly and critical edition of the "Tristia" by S. G. Owen, published by the Clarendon Press for the University of Oxford, the first volume of which appeared in January, 1886, and the remaining volumes at short intervals afterwards. Though small in bulk, it is executed with remarkable care, utilizing all the available materials of five centuries of Ovidian study, and issuing with the united authority of all our chief Latin scholars. It is a matter of congratulation to find classical criticism gradually passing to its old English ascendancy; for as to Ovid, until this edition appeared, the best recent work was by German hands.

Ehwald's edition of Merkel (1884), Gühtling in the same year, the excellent dissertation of Tank (1879), and the monographs of Grüber, Koch, Lorenz, and Washiett, were the sources of new light. Now all these are absorbed by Owen and our English professors, and large additions made to them, especially in the direction of an exhaustive commentary and valuable collations of the original (untitled) codices, &c. It may be added that one of the best copies (thirteenth century) of Ovid, next to the famous Laurentian Codex of Milan, is that on vellum, in the library of the Earl of Leicester at Holkham, which rivals the Wolfenbüttel thirteenth century MS. and exceeds that of the Vatican (1606).

OVIEDO, a town in Spain, the capital of the province of Asturias, is situated 61 miles N. from Leon, on the Ove, a feeder of the Nora, and has about 13,000 inhabitants. The town, which is said to have been founded by Fruela I., the grandson of Pelayo, in 759, although some authorities assert that it existed previously to that time, derives its name from the river Ovia, or Ove, on which it stands. During the middle ages Oviedo was known by the title of *Civitas Episcoporum*, owing to the great number of bishops who, being exiled by the Moors, took refuge in this place. Oviedo is the seat of a bishop. It is a neat, clean, well-built town, with several straight and regular streets, the principal of which commence from a handsome plaza or square in the centre, and terminate in alamedas or public walks.

Oviedo contains an episcopal palace, a cathedral, a collegiate church, and several other churches, interesting for their great antiquity; it has also a castle, theatre, several convents and hospitals. The university, just outside the town, is well endowed, and contains a library. The cathedral is a magnificent structure, of the pure Gothic style, equalled perhaps by none in the peninsula. It once contained a rich treasury of valuable vases, relics, and other ornaments, but these were almost entirely lost during the French war. The remains of fourteen kings and queens of Asturias are deposited in one of the chapels. The royal arms factory here employs over 500 workers; 5 miles west is the cannon foundry of Trubia. There are some hot mineral springs and baths in the vicinity. The principal manufactures are of arms, hats, and leather.

OVIFAK is a locality on the Island of Disco, off the Greenland coast, rendered classical in mineralogy by the discoveries of Professor A. E. Nordenskjöld in 1870. On the shore there are to be found a number of blocks of metallic iron, alloyed with nickel and cobalt, and indistinguishable from ordinary metallic meteorites or *AEROLITES*. The surrounding district, however, is occupied by extensive beds and dykes of a basalt, which is of great interest on account of its numerous small inclosures of the same metallic nature, and there appears to be little doubt that the loose masses of iron on the shore are all of terrestrial origin and have been left behind, on account of their indestructibility, while the enveloping rock has been denuded away. On this supposition they have been brought up with the lava-flows from the earth's interior, and probably from enormous depths which are rarely disturbed and extruded under ordinary circumstances; for all modern researches tend to support the hypothesis that the inner parts of the globe consist of metallic substances—mainly iron—uncombined with oxygen, and it would thus appear that the Ovifak eruptions had a very deep-seated source. Microscopical particles of metallic iron have also been noticed in the basalts of other regions, and it is quite possible that some of the metallic lumps occasionally unearthed and regarded as of extra-terrestrial origin, have like-

wise been brought up by volcanic action from great depths in the interior of the globe.

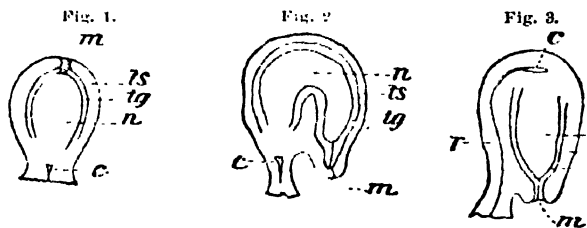
OVIP'AROUS. An animal is said to be oviparous when the ovum or egg is excluded from the body entire, and hatched after such exclusion. Birds and the great majority of reptiles are oviparous animals. In 1884 the *Monotremata*, the lowest in the mammalian class, were discovered to be oviparous.

OVO'CA or **AVOCA**, a river of Ireland, in the county of Wicklow, formed by the junction of the Avonmore and Avonbeg, celebrated in Moore's "Meeting of the Waters," and flowing south and south-east 9 miles into the Irish Sea at Arklow, through a valley of great picturesque beauty.

O'VOVIVIP'AROUS (Lat. *ovum*, an egg; *vivus*, alive; *paro*, I produce). An animal is said to be ovoviviparous when the egg is retained within the body till hatched, and the young one is excluded alive. Thus, among the reptiles, the young of the lizard, known by the name of *Zootoca vivipara*, the viper, the rattlesnake, and the blind-worm, are hatched before they are excluded from the body, and not long before such exclusion; indeed it is probable that the rupture of the egg takes place during parturition.

O'VULE, in botany, is the rudimentary seed. If the flower of a pea which has just opened be examined carefully, the pod, in a very young condition, will be found situated in the centre of the flower. As all the parts of a flower are modified leaves, so the pod is a single leaf closed on itself so that the margins cohere. This metamorphosed leaf is called a carpellary leaf or carpel. On the margins are situated the young peas or ovules. The inclosed portion of the carpel is called the *OVARY*. The ovules first make their appearance as tiny knobs, composed of simple cells, but by the time the flower has opened the cells have become differentiated to a great extent, and the ovules have acquired a definite form. The tiny stalk by which they are attached is known as the *funiculus*, and the portion of the ovary from which the stalks spring is called the *placenta*. The point at which the ovule is attached to the stalk is called the *chalaza*. The ovule consists essentially of a mass of cells called the *nucellus*. In most cases the nucellus is covered by one or two envelopes, which commence their existence as rings at the chalaza, and gradually grow up round the nucellus, so as to inclose it completely except for one minute opening, the micropyle, through which the pollen-tube penetrates to the nucellus. The inner coat is the first formed. When the ripe seed breaks away from its stalk it is often marked, as in the pea and bean, by a scar at that point, and this is called the *hilum*. The mistletoe is an example of a plant in which the nucellus has neither inner nor outer coat; many have only one.

When the nucellus is straight, and is a continuation, as it were, of the funiculus, the micropyle is opposite to the chalaza, which is itself placed directly above the hilum,



Diagrams of Ovules.

Fig. 1, orthotropous; fig. 2, anatropous; fig. 3, circinate; n, u, nucellus; ts, the outer envelope; lg, the inner envelope; m, the micropyle; c, the chalaza.

from which it is only separated by the thickness of the envelope. In this case the ovule is said to be *orthotropous* (see fig. 1). This form is somewhat rare; it occurs

in the nettle and some other Angiosperms, also in Gymnosperms.

At other times the ovule grows more strongly on one side than the other, so that at length both nucellus and envelope are curved like a horse-shoe, the micropyle approaching the hilum and chalaza. This kind of ovule is *campylotropous* (see fig. 2); it is found in Crucifere, Caryophyllaceæ, Chenopodiaceæ, Solanaceæ, Alismaceæ, some Camenæ, and some grasses.

The most usual form is that in which the nucellus becomes completely inverted (not simply curved) by the adhesion of the funiculus to one side of the ovule; so that while the nucellus is straight, the micropyle is now close beside the hilum, and the chalaza is at the opposite end. This form is called *anatropous* (see fig. 3). The funiculus forms on the side of the ovule a ridge which is called the raphe.

The Santalaceæ and Balanophoreæ have ovules without envelopes. All Gymnosperms and almost all Gamopetalæ have only one envelope; while most Polypetalæ, Apetalæ, and Monocotyledons have two envelopes. It must be remarked that the same family, and even the same genus, may contain plants which have ovules with either one or two envelopes; thus, Clematis has two, while Ranunculus has only one; and again, *Delphinium Consolida* has two, whereas there is but one in *Delphinium tricolor*.

There is sometimes a growth in common between the nucellus and the integument; thus in Gymnosperms they are united to a distance of two-thirds from the base; in the anatropous ovule of the castor-oil plant the outer envelope is free, but the inner one is united to the nucellus two-thirds of the way; and the same takes place in certain Scrophulariaceæ, &c. In the same way the ovule may grow *pari passu* with the ovary, so that it is impossible to see any line of demarcation between the two, as for instance in Lauragorflia, one of the Balanophoreæ. So the two orthotropous ovules of the fir are united by their lower face to the carpel.

In Angiosperms there is always a single cell much larger than the rest situated near the micropyle, and containing a large nucleus. This cell is called the *embryo sac*. At its upper end there are three protoplasmic bodies without cell-walls, but each provided with a nucleus; two of these are closely attached to the wall of the sac, they have only a temporary existence, and are called the *synergids*. The third one lying between these, a little lower, is the *oosphere*, destined after fertilization to become the embryo. At the base of the embryo-sac again there are three cells, each with nucleus, and generally a delicate cell-wall, they are called the antipodal cells.

In Gymnosperms the embryo-sac is filled before fertilization with a tissue of cells called the endosperm. At its apex there are several long cells, the *corpuscula*; each becomes separated from the wall of the embryo sac by the formation in it of four small cells, the rosette, and constitutes the oosphere.

The funiculus and envelope are considered to represent the stalk and limb of a leaflet in a compound leaf. The funiculus is traversed by a small nerve, which is a branch of one in the carpellary leaf, and which branches again in the envelope. The nucellus never contains nerves, and is regarded as a protuberance from the surface of the enveloping leaflet or leaf-segment, or of the carpellary leaf, or sometimes from the axis itself. In Angiosperms it appears that it is always on the upper face of the foliar organ that the nucellus is developed, whereas in Conifere it is on the lower face.

As regards the morphological nature of the ovule there is much doubt. In some rare cases, e.g. in Taxus and the Polygonaceæ, the nucellus being the terminal portion of the floral axis, may therefore be considered to be a metamorphosed stem-structure (*caulome*). In less rare cases the

ovules grow laterally on the floral axis, as in Juniper, the Primulaceæ, and Compositæ; thus they correspond to leaf-structures (*phyllous*). Usually, however, the ovules spring from true leaves—the carpels—sometimes from their upper surface (as in Butomus, Nymphaea), but generally from their margin, like pinnae from a leaf (e.g. in Cycas). The latter may be considered as metamorphosed pinnae. "For those ovules which spring from the surface of carpels there is no clear analogy with any purely vegetative structures (&c. with any that do not subserve the purpose of fertilization); though in this case we may be reminded of the sporangia of Lycopodium" (Sachs). Goebel, however, suggests that, in view of the great variety of position in their development, it is better not to assign them to the categories of phyllome and caulome, but to regard them as organs having a morphological value of their own. (See Sachs' "Text book of Botany," 1882.)

OVUM (Lat., the same word as the Greek *ovon*, an egg) is an anatomical term for the body formed by the female, after impregnation, in which occurs the development of the fœtus. This usually takes place in a definite part called the *ovarium*, but in the polyps and other simple types of existence the common cellular tissue of the body seems able to produce an unlimited amount of ova. In the formation of the ovum first appears a minute pellucid cell, called the *germinal vesicle*, which is distinguished by an opaque speck, known as the *germinal spot*. This is closely surrounded by a layer of granules or "nucleated cells," which compose the *germinal disc*. These float in a fluid of some distinct and definite colour, called the *yolk*, which is inclosed in a thin coating, the *vitelline membrane*; and that, in its turn, is protected by an external covering, called the *chorion*, between which and the vitelline membrane occurs a greater or lesser quantity of albumen. Such are the principal component parts of the *ovum* in all animals, the human genus included.

OWEN, DR. JOHN, an illustrious English nonconformist, was born in 1616 at Stadham in Oxfordshire, of which place his father was minister. He took his first degree at Queen's College, Oxford, in 1632; but after being admitted into holy orders was obliged to leave the university in consequence of resisting some new regulations made by its chancellor, Archbishop Laud. On the breaking out of the Civil War he lost the office which he had for some time held of chaplain to Lord Lovelace, and joined the Presbyterian nonconformists. In 1642 he published his first work, "A Display of Arminianism," which became the foundation of his future advancement. He was promoted in 1642 to the living of Fordham, in Essex, which he only enjoyed until 1646, afterwards removing to Coggeshall in the same county. He soon afterwards left the Presbyterian for the Independent party, and gained great distinction for his moderation and tolerant principles. Cromwell, on hearing him preach, was so favourably impressed by his great powers that he appointed him his chaplain. In 1651 Owen was made dean of Christ Church, and the following year vice-chancellor of the University of Oxford. On the death of Cromwell he was deprived both of that office and his deanery. After the Restoration, refusing all the temptations of Clarendon to induce him to rejoin the Established Church, he formed a congregation in London; and in conjunction with Baxter, Bates, and other leading men of his persuasion instituted the Finner's Hall weekly lecture. He died 24th August, 1683.

Owen was a man of much erudition and profound piety, and he exerted a great influence over his countrymen. A prominent actor in the ecclesiastical and political movements of his time, as well as an untiring author, he was characterized in both departments of activity by his integrity and love of usefulness. His works are numerous, for during his life he issued more than eighty separate publications, many of them of great size. Among the

more important may be mentioned his "Exposition of the Epistle to the Hebrews" (four volumes folio, London, 1668-84); "On the Doctrine of Justification" (1677); and "The Nature of Indwelling Sin" (1668). See Orme's "Memoirs of Owen" (London, 1820); "Works" (twenty-eight vols. 8vo, London, 1826, ed. Russell; twenty-four vols. 8vo., Edinburgh, 1850, ed. Gould).

OWEN, SIR RICHARD, F.R.S., a celebrated comparative anatomist and biologist, was born at Lancaster, 20th July, 1801. He was educated at the grammar-school of that town, and after serving for a short time as a midshipman in the navy, he adopted the medical profession, becoming at the age of twenty a student in Edinburgh University. From Edinburgh he moved to St. Bartholomew's Hospital, London, in 1825, and became a member of the College of Surgeons in 1826. He soon attracted the notice of Abernethy, who made him one of the dissectors for the apothecial class, and obtained for him an appointment as assistant-curator of the Hunterian Museum of the Royal College of Surgeons. In 1831 he was appointed to the chair of comparative anatomy at St. Bartholomew's, and soon afterwards he married the only daughter of his colleague at the Hunterian Museum, Mr. William Clift. On the death of Mr. Clift, in 1835, Owen was appointed conservator of the museum in the Royal College of Surgeons; in 1836 he succeeded Sir Charles Bell as professor of anatomy and physiology at the college, and the same year was appointed first Hunterian professor. On entering on his office at the Hunterian Museum he found the specimens of comparative anatomy had been left undescribed, and he at once undertook the enormous labour of comparing the preparations with recent dissections, in order to discover the species of animals to which the specimens belonged. One result of his labours is to be found in the splendid series of illustrated catalogues, the issue of which was commenced in 1830 by the "Preparations of Natural History in Spirit." He very materially assisted Mr. Clift in this catalogue, as well as in the catalogues of "Pathological Specimens" (1830), and "Monsters and Malformations" (1831). Subsequent catalogues prepared by Owen alone were those of the "Physiological Series of Comparative Anatomy" (1833-40); "Palaeontology," of which Mammals and Birds appeared in 1815, Reptiles and Fishes in 1864, and Invertebrates in 1836 (the latter in conjunction with Professor Morris); "Osteological Series" (1853), in which nearly 6000 specimens were described. Another result is to be found in the fact that when, in 1856, he resigned his connection with the museum the collections had been enlarged until they occupied ten times the space required in 1828. He took an active part in the organization of the Great Exhibition of 1851, and also of the Paris Exhibition of 1855, receiving for his services in the latter capacity the Cross of the Legion of Honour. In 1856 he was appointed superintendent of the Natural History department of the British Museum, when his connection with the College of Surgeons ceased. In his new office he displayed the same zeal for improvement which had characterized his former position, and in his "Discourse on the Extent and Aims of a National Museum of Natural History," he advocated the provision of adequate galleries for the exposition of these collections. His ideas in this respect were afterwards realized in the erection of the magnificent Museum of Natural History at Kensington, the arrangement of which was intrusted to him.

It is impossible, in the short space of this notice, to enumerate even the bare titles of all the papers and treatises which have emanated from his pen between the publication of his celebrated memoir "On the Pearly Nautilus," in 1832, and the present time. On every branch of the animal kingdom, living or extinct, he has published original papers, and his important discoveries and generalizations must for ever associate his name with

the study of natural history. Among the principal of his works are his "Odontography" (two vols. 1810-45); "Lectures on the Comparative Anatomy and Physiology of the Invertebrate Animals" (1843, second edit. 1855); "Lectures on the Vertebrate Animals" (three vols. 1846, second edit. 1866-68); "History of British Fossil Mammals and Birds" (1846); "On Pangenesis" (1849); "On the Nature of Limbs" (1849); "History of British Fossil Reptiles" (1849-51); "Principes d'Ostéologie comparée" (Paris, 1855); "Palaeontology" (1860, second edit. 1869); a treatise on the "Fossil Reptilia of South Africa," with seventy plates (published by the trustees of the British Museum, 1876), and a work on the "Fossil Mammals of Australia, and on the extinct Marsupials of England" (two vols. 4to, 1877).

In addition to these large works Owen's contributions to science include an immense number of papers communicated to the Transactions of the Royal, Linnean, Geological, Zoological, Cambridge Philosophical, Medico-Chirurgical, and Microscopical Societies, together with some elaborate reports which have been published in the *Transactions of the British Association*. In his treatise "On the Nature of Limbs," he announced, as the result of his researches on the unity of plan of animal organization, that he had been led to regard species as being due to a secondary cause, or law, continuously operating and producing them successively, but in a way unknown to him. In 1855 he propounded his theory of "natural rejection," by which, in the struggle for existence, certain genera became extinct; and in this, as also in his views regarding the evolution of species, he prepared the way for the reception of the wider hypothesis of Darwin. The latter theory, however, he never accepted as final, and in common with Agassiz, Mivart, Carpenter, and others, has preferred to suspend judgment until the subject has been more fully investigated.

His important services in the advancement of science have not passed unrecognized. He was one of the founders and first president of the Microscopical Society, and has been made a fellow or associate of most of the learned societies or scientific academies at home or abroad, a Chevalier of the Order of Merit of Prussia, one of the eight Foreign Associates of the French Institute, and a Foreign Member of the Berlin Academy of Sciences. He was created a Companion of the Bath, 3rd June, 1873, and knighted on the occasion of his retirement from the superintendence of the Natural History department of the British Museum in December, 1883.

OWEN, ROBERT, philanthropist, socialist, and secularist, was born at the village of Newtown, Montgomeryshire, 14th May, 1771, where his father was a saddler and ironmonger in a small way of business. He received a very limited education, and at the age of ten was placed in a draper's shop, where he remained a few years, afterwards removing to Manchester, where he entered a cotton mill and quickly rose to the position of manager. Under his care the mill, in which 500 persons were employed, became one of the best in England, and at the same time he rapidly improved his own position. In 1799, being then a partner in a flourishing company of Manchester cotton-spinners, he married the daughter of Mr. Dale, the proprietor of the New Lanark Mills, and in 1800 settled there as manager and part owner. These mills had been established in 1784 by Arkwright, and at this time they supported about 2000 persons and comprehended a farm of about 150 acres. The condition of the operatives at this time was very unsatisfactory; hardly worked, poorly paid, and generally neglected, they had become dishonest, drunken, and immoral, and it was these people whom Owen resolved to turn into a model community. He started infant schools for the young children, improved the dwellings of the adults, restricted the sale of

drink, and opened a store where they could buy goods of the best quality at little more than cost price. Soon habits of order, cleanliness, and thrift were formed under his benevolent supervision, and while the mills continued to be a great commercial success, the improved condition of the operatives attracted widespread attention. Some of the partners, objecting to his benevolent expenditure, were afterwards bought out by Owen, assisted by Jeremy Bentham and the Quaker William Allen, and New Lanark became a place of European fame. For several years it was a place of pilgrimage for reformers, philanthropists, and statesmen, one of the most famous of the visitors being Nicholas, afterwards Emperor of Russia. In 1813 Owen published in his "New View of Society" an account of his principles, the chief distinguishing features of which were his theories of man's irresponsibility and entire dependence upon circumstances, and the all-powerful influence of early training. Although he had arrived at his conclusions by a process of independent thinking, the only point that was new in his system was that such principles should lead to active benevolence. In 1817 he advocated, in a report communicated to the committee of the House of Commons on the Poor Law, the establishment of a system of communism, by which people should be divided into little colonies of about 1200 persons, devoted partly to agricultural and partly to manufacturing pursuits. Some of his plans and ideas were favourably received by the press and the public, but when, soon afterwards, he made a public attack upon all forms of religion he fell into discredit, and Owenism was ever afterwards associated with infidelity. In 1825, however, he endeavoured to form a community on his own plan, and he purchased an estate of 30,000 acres in Indiana, which he entitled the colony of New Harmony. One of his disciples, Abram Combe, in the same year established a similar colony at Orbiston, near Glasgow. As might be expected, they quickly proved utter failures, and in less than two years the experiments came to an end. Owen, however, never lost faith in his schemes, and though his finances were seriously crippled by his losses in connection with New Harmony, he continued for many years afterwards to propagate the principles of secularism and socialism, by means of tracts and lectures, with the most untiring energy. His influence over the poorer classes of the towns was considerable, but his lax views concerning the sanctity of marriage, and his anti-religious teaching, gave great offence to the majority of the nation. During the revolution of 1848 he went to Paris, with great hopes of reorganizing that troubled society, but he could not get a hearing. In his later years he became an ardent convert to spiritualism, and published some imaginary conversations with Benjamin Franklin and other distinguished men, who had communicated with him by spirit-rapping. His last public appearance was at the Social Science Congress at Liverpool in 1858. He died at Newtown, 14 November, 1858.

In his personal character Owen was without reproach, and whatever may be thought of his socialistic theories, there can be no question as to his disinterestedness and benevolence in their advocacy. In spite of his extravagance he accomplished much useful work. He was the first to establish infant schools in England; he did much towards shortening the hours of labour in factories, and he must be regarded as the real founder of the co-operative movement.

OWHYHEE. See HAWAII.

OWL (Strigidae), a numerous family of birds belonging to the order ACCIPITRES. The owls differ considerably from the other birds of prey, and some would remove them from their company, making them a separate order, Striges. The owls for the most part are nocturnal in their habits, and their structure has an evident relation to this mode of life. Thus the plumage is very soft and downy,

rendering their flight perfectly noiseless, so that these birds are enabled to execute the most rapid manoeuvres in the air without producing any flapping sound to give notice of their approach to the most wary of their prey. Their eyes are of very large size, and look directly forward; they are adapted to night vision, and most owls are much disconcerted when exposed to the strong light of day. The ears are also large, and are usually furnished with a kind of lid or operculum to cover the orifice.

The head is disproportionately large, fully feathered, and furnished with erectile tufts of feathers, the so-called ears or horns, and there is no ridge over the eyes, as in the Falconidae. The face feathers are somewhat hair-like, and are arranged in a radiating form round the eyes, constituting a peculiar disc of irregularly circular form on each side of the face. In some cases this disc completely surrounds the eye; in others the upper part of the face is clothed with ordinary feathers, and the peculiar feathers of the disc are only seen beneath and on the sides of the eye. The feathers of the face bordering the inner margin of the eye, which form the inner part of the facial disc, project more or less forwards, and conceal the base of the bill, which is short and hooked, and furnished with a naked cere. The owls differ from most accipitrine birds in their feathers lacking the after-shaft or accessory plume.

The wings are rather short, broad, and rounded, indicating far less power of flight than is possessed by any of the hawks and vultures; but the legs are stout and powerful, and armed with sharp-curved claws. The whole of the tarsi and the toes nearly to their tips are generally clothed with feathers, which are usually of a hair-like texture. The outer toe in each foot is reversible, or capable of being turned backwards, in the manner of that of a parrot.

These birds are solitary in their habits, living in pairs in the holes of trees, rocks, old buildings, and other retired places, where they conceal themselves during the daytime, issuing forth in the evening to seek their prey. Some, however, are as active by day as any of the hawks. The largest species prey on small mammals, hares, fawns, and especially rats and mice, on birds, and sometimes on fishes. The smaller owls also feed frequently upon the insects, such as moths and beetles, which come abroad in the twilight. The indigestible portions of all their prey are collected in the stomach into little pellets, which are then disgorged. Their voices are generally loud and discordant, and when heard in the silence of the night have, no doubt, had much to do with the superstitious fear with which these birds have been commonly regarded in most ages. Their sudden and noiseless flight and their love of churchyards and ruins have also contributed to this almost universal dislike. The Athenians alone regarded the owl with respect, for it was sacred to their tutelary deity, Pallas Athene, and so became the emblem of wisdom.

The species of this family are very numerous, and its subdivision into minor groups is a matter of some difficulty. Much confusion has also arisen in the nomenclature, the old Linnæan term, *Strix*, being used for different genera by different naturalists, the Tawny Owl (*Strix stridula*, Linnæus) being regarded by Brisson as the type of his restricted genus, *Strix*, and the Screech or Barn Owl (*Strix flammea*, Linnæus) being afterwards taken as the type by Savigny. Two subfamilies may be established, Striginæ, of which the Tawny Owl is the type, containing the majority of the species, and Alucinae, of which the Screech Owl (*Aluco flammeus*) is typical. The Tawny Owl (*Strix stridula* or *Syrnium aluco*, see Plate, fig. 1) or Brown Owl, the largest native owl of England, is common in wooded districts in England, but less abundant in Scotland; it is found throughout Europe, extending to Asia Minor and Palestine and North Africa. It feeds largely on mice, rats, shrews, and moles. The eggs, three or four in number, are usually deposited in a hole in a tree, but sometimes in

the deserted nest of another bird. The length of the male is about 15 inches, the female being slightly larger. The upper parts of the plumage are ash-gray mottled with brown, the under surface grayish-white mottled and streaked with brown. Its loud hooting, "tu-whit, to-who," is considered by some doleful, but Shakspeare calls it a "merry note." The tawny owl is represented in the United States by the Barred Owl (*Strix nebulosa*), a similar but larger species. The genus *Bubo* contains the EAGLE OWLS. The Snowy Owl (*Nyctale scandiaca*, fig. 3) inhabits the more northern parts of both hemispheres, and visits the Shetlands and Orkneys every year; it has also been taken, though rarely, both in Scotland and England. It is a large bird with white plumage, spotted, and barred with dusky brown. It inhabits the open mountainous districts, and feeds on birds, fish, hares, &c. The Long-eared Owl (*Asio otus* or *Otus vulgaris*) is not uncommon in wooded districts in England; it inhabits Europe, extending to India and North Africa, and is also abundant in the United States and Canada. It is distinguished by the possession of long ear-tufts, which can be elevated or depressed at pleasure. The Short eared Owl (*Asio accipitrinus* or *Otus brachyotus*), with shorter ear-tufts and a more extensive range, is called the Woodcock Owl in England, for, though many stay in this country throughout the year, their numbers receive a great increase in the autumn by an immigration, coincident with that of the woodcocks, from Scandinavia. This species frequents the open country, feeding on small mammals and birds, and in the Orkneys is said to pursue its prey by day. The Scops Owl (*Scops glauca*), a little owl about as big as a thrush, is well-known in Southern Europe, and is occasionally taken in Britain. The Little Owl (*Cariacus noctua*), another occasional visitor to this country, is the bird selected by the Athenians as the favourite of their goddess; it is still abundant in Greece, and in Central and Southern Europe generally. The Hawk Owl (*Surnia funerea*) inhabits the pine-forests of the more northerly parts of both hemispheres. It hunts by day, feeding in winter on ptarmigan and grouse. The BARKING OWL (*Athene* or *Speotyto cunicularia*) is a remarkable American owl. The FISH OWLS (*Ketupa*) have their tarsi and toes bare of feathers, and make fish their usual diet.

The Screech or Barn Owl (*Aluco flammeus* or *Strix flammea*, fig. 2) is the commonest owl in Britain. It has a most extensive geographical range, being found all over the world, except in the more northerly parts of North America, Sweden, Norway, and New Zealand. The barn owl does not shun the proximity of man, but takes up its dwelling in old buildings, barns, hollow trees, &c. Both farmers and gamekeepers persecute this species most undeservedly, for it destroys vast numbers of rats, mice, shrews, and other vermin. The barn owl is about 14 inches long; it has the facial discs complete, and has no ear-tufts. The whole upper surface of the bird is of a light reddish-yellow colour, minutely mottled with ashy gray, and marked with combined small black and white spots; the facial discs and the whole of the lower parts are white, the latter sometimes marked with a few dusky spots. The tail feathers are of the same colour as the upper surface, but marked with five transverse gray bars; the beak is nearly white, and the claws brown. The eggs, two to six in number, are laid in a nest consisting of a few sticks and straws. It appears that this owl rarely incubates her eggs after the first or the first pair has been hatched, leaving the others to hatch out by the warmth of the owlets' bodies. This owl is strictly nocturnal in its habits, and it seldom leaves its retreat till dusk. Its cry is a loud discordant scream.

OX (*Bos taurus*), a ruminant animal belonging to the family BOVIDÆ. The domesticated breeds of oxen, with which this article deals, must be distinguished from those of the genus (*Bos indicus*), which inhabit tropical countries

and have a dorsal hump. The European breeds of oxen are numerous, nineteen British breeds having been enumerated, only a few of which are identical with those on the Continent. They are probably all derived from three distinct species, *Bos primigenius*, *Bos longifrons*, and *Bos frontosus*. *Bos primigenius*, the Urus of Cæsar, was domesticated in Switzerland during the Newer Stone Age. Some of the Continental breeds, as the Friesland, and also the English Pembroke breed, are considered to be the descendants of the Urus; and the British wild oxen, of which those at Chillingham are the purest breed, come nearest to this wild species. The Chillingham cattle are quite wild in their habits; they are smaller than domestic cattle, and of a white colour, the inside of the ears being reddish-brown, the muzzles brown, and the horns of moderate length, sharp, and white, tipped with black. The uniformity in colour, however, is to be ascribed to the care taken to destroy every calf varying from the pure type. Other wild cattle exist at Chartley and a few other places, being strictly preserved in all. These park-cattle are considered by some to be the descendants of a domesticated race which have run wild, and reverted in some respects to the ancient type. The second species (*Bos longifrons*) was also domesticated by the lake-dwellers of Switzerland; and large herds of this species, in a domesticated state, existed in Britain at the time of the Roman invasion. The Welsh and Highland breeds, and some of the Swiss breeds, are thought to have descended from this species. It was of small size, with short horns. *Bos frontosus* is regarded by some as identical with *Bos longifrons*, with which it co-existed in Scandinavia; remains of the two species have also been found together in Irish crannogs. *Bos frontosus* is considered the parent form of the mountain cattle of Norway.

The various breeds of Europe and of England may now be considered especially with reference to their economic value. Poland presents us with a white or grayish-white breed, of large stature, with long sharp horns; and a



Wild Bull of Campagna.

similar race exists in Hungary. Of both these breeds specimens are preserved in the British Museum. They are better fitted for work than for the dairy; they fatten readily when stalled, and are driven in herds from their native plains, and sold to the graziers in the adjacent districts of Germany. A noble breed of white cattle grazes in the solitudes of the Campagna of Italy. In the plains of Jutland, Holstein, and Schleswig, a fine breed of cattle, with short crumpled horns, prevails, capable of much improvement; this stock fattens quickly, and is much esteemed in the northern parts of Europe. The Friesland, Oldenburg, Dantzic, and Tilsit cattle are mostly varieties of this short-horned breed. This breed is said to have been introduced into Spain by the Goths, and so to be the parent-form of the immense herds of

cattle which have run wild on the pampas of South America since the conquests of the Spaniards.

Towards the Alps the cattle have a different character; they are strong and active, and well fitted for a wide-ranging and mountainous pasturage. Of the Swiss cattle, the Freyberg race is perhaps the finest; it occupies the rich pastures between the mountains in the neighbourhood of Greyerz (Gruyères), a place celebrated for its excellent cheese. The cows are middle-horned, and give rich milk; the oxen work well, and when stalled on clover or lucerne fatten readily, and yield beef of good quality. In the Jura there is a smaller but very active breed of cattle, well adapted for their mountain home, and thriving on scanty food. The oxen are inured to labour, and draw by the horns. The cows are slightly built, and generally of a light red.

Among the French breeds, which are numerous, that of Normandy may be particularized, inasmuch as it gives a stamp to the character of the cattle of northern France generally. These cattle are short-horned, with slender limbs, high hips, and thin thighs. The milk of the cows is very rich and of fair quantity. The Alderney and Jersey breeds are smaller varieties of the Norman; these are much prized in gentlemen's dairies in England.

In the north of Italy, where the Parmesan cheese is manufactured, the cattle resemble those of Switzerland; but in the more southern provinces little pains is taken with the ox. The buffalo is used as a beast of draught and burden.

Of British breeds the long-horns were brought to great perfection by Robert Bakewell, of Dishley, who founded what was called the New Leicester or Dishley Stock, a stock peculiarly fitted for the grazier, and remarkable for smallness of bone, rotundity of contour, and a disposition to the laying on of fat where its accumulation was most advantageous. The flesh was fine-grained and well marbled. The beneficial influence of the Dishley breed extended even to the old long-horns of Ireland; but this once celebrated breed, after the death of Mr. Bakewell, soon began to deteriorate, and has now given place to the short-horns. The short-horns had long been known in the counties of Durham and York, before the time of Messrs. Collings. The cows were held in reputation as milkers, but the oxen were indifferent feeders, coarse and ill-formed, and produced meat of inferior quality. The change which these breeders' care and pains have effected is very great. In no class of cattle is this more apparent; for now, while the milking properties are preserved, the tendency to fatten is brought to a high degree; and these qualities are combined with size, a magnificent figure, and the production of beef of the highest excellence. Almost every good short-horned breed now in existence traces its pedigree to the stock of Mr. C. Collings, and especially to his famous bull Hubback.

The excellence of the short-horn breed is fully acknowledged, and these cattle have been exported in great numbers to the Continent and to America and Australia, and are now spreading over the world. Most of the other breeds may be roughly classed as middle-horns; but this must not be taken as implying that they are descended from one and the same stock. The Hereford breed is in great repute for its beef, the carcass being massive and compact, but the cows are poor milkers. The North Devon is a nearly allied breed of powerful build and docile temper, so that it is particularly adapted for agricultural labour. The Galloway and Angus cattle are black and destitute of horns; they are valuable both to the grazier and for good milking qualities. The kyloes, or West Highland cattle, are particularly adapted by their hardy constitution to their homes in the highlands of Scotland and the Hebrides. The milk is very rich, but the quantity yielded is too small for dairy purposes; the beef is, however, excellent. The Pembroke and other

Welsh breeds are very like the Highland cattle, but excel them in the quantity of milk which the cows yield. The Shetland cattle are very hardy and excellent both for milk and beef, but they are extremely diminutive. The Ayrshire breed is unsurpassed for dairy purposes, the quantity of milk yielded being very great; the beef is of an inferior quality. Another famous dairy breed is the Suffolk Dun, a polled or hornless breed; they are of little value to the grazier, but yield a large quantity of milk. The Alderneys bear a great resemblance to the Ayrshire cattle; they yield only a small quantity of milk, but are remarkable for the richness of the cream and the quality of the butter obtained from their milk. See ROVIDER, COW, CATTLE, DAIRY, AGRICULTURE.

OXALIC ACID, an acid first obtained by Scheele in 1776 from salt of sorrel or acid oxalate of potassium. It is extensively diffused throughout the vegetable kingdom, particularly in species of *Oxalis* and *Rumex*, in which it exists in combination with potassium; in combination with sodium it is found in species of *Salsola* and *Salicornia*, growing in salt marshes. Calcium oxalate is a common constituent of plants, and is often found in the cellular tissue in minute crystals, known as raphides. Lichens contain this salt in quantity. It is frequently a constituent of human urine, and forms one of the urinary calculi. Oxalic acid is a common product of the oxidation of organic compounds. It may be obtained from cane-sugar by acting on it with hot nitric acid; on cooling the solution it is obtained in large crystals; treacle or starch may be used instead of sugar on the large scale; but this process has given place to a less expensive and more productive method, by which it is now manufactured in large quantities. The method consists in heating sawdust with a mixture of caustic potash and caustic soda; the product is treated with water, and sodium oxalate is left behind; this is converted by calcium chloride into calcium oxalate, from which the oxalic acid is separated by sulphuric acid. It crystallizes in large monoclinic, colourless crystals, containing two atoms of water, and having the formula $C_2C_2O_4 \cdot 2H_2O$. It is very soluble in water and alcohol. The crystals melt at $100^\circ C.$ (212° Fahr.) in the water of crystallization, and partially sublime; at a higher temperature it decomposes, forming carbonic acid and formic acid, the latter being again decomposed into carbonic oxide and water. When heated with oxidizing agents it is converted into carbonic acid and water; and with dehydrating agents, such as sulphuric acid or phosphoric acid, into water, carbonic acid, and carbonic oxide.

It is dibasic and forms two series of salts, having the general formula for neutral salts, $C_2M_2O_4$, and acid salts, C_2HMO_4 . Those of the alkalis are soluble. The most important are ammonium oxalate, $C_2(NH_4)_2O_4 \cdot H_2O$, a salt crystallizing in colourless rhombic prisms, very soluble in water. It has been found in gumo. It is much used in analysis for the detection and estimation of lime. When a solution of an alkaline oxalate is added to a salt of lime, calcium oxalate (C_2CaO_4) is always formed. It is insoluble in acetic acid, but soluble in hydrochloric acid, and its formation is a characteristic test for the presence of oxalic acid or lime. It is found in microscopic crystals in the juice of many plants, and sometimes forms half the weight of lichens growing on calcareous rocks. The marble of the Parthenon in Athens is incrustated with a coating of this salt, deposited by a species of lichen growing on it. Ferrous oxalate occurs native as oxalite in lignite. It is employed for the manufacture of jewellers' rouge or pure peroxide of iron, which is obtained by igniting it. Potassium oxalate ($C_2K_2O_4 \cdot H_2O$) is a neutral crystalline salt. Potassium binoxalate, or acid oxalate, is the well-known salt of sorrel (C_2HKO_4), so called from its having been obtained from the *Oxalis acetosella*, natural order Oxalidaceæ. It is employed as a weak acid for cleaning metals,

and/or removing iron moulds and ink-stains from linen. It acts by forming with the iron a double oxalate of iron and potassium, soluble in water. Oxalic acid forms many such double salts. Oxalic ether or neutral ethyl oxalate ($C_2H_{10}O_4$) is a colourless oily liquid of aromatic odour, having a specific gravity of 1.0824, and a boiling point of 183° C. (361° Fahr.)

Oxalic acid is extremely poisonous. It has been often mistaken for Epsom salts, which the crystals resemble. The effects are rapid and require prompt treatment. The best antidotes are chalk or magnesia, administered in the form of a cream with water. Oxalic acid is largely used in commerce, especially for the bleaching of straw in making straw-hats, and in calico printing and dyeing.

OXALIDÆ is a tribe of the order GERANIACEÆ, containing among others the genera *AVERRHOA* and *OXALIS*. The species are herbs, shrubs, or trees. The parts of the flowers are in fives. The fruit is a five to ten-valved capsule, with several albuminous seeds.

OX'ALIS, a genus of plants belonging to the order GERANIACEÆ, and tribe OXALIDÆ. (*Oxalis acetosella* (common wood sorrel) is a small perennial plant, having a pleasant acid taste, dependent on the presence of oxalic acid, and is frequently used in salads; its flavour approaches near to that of lemons or tartaric acid, with which its medicinal effects also correspond, as it is esteemed a refrigerant and antiscorbutic. It has been claimed as the true shamrock instead of the Trifolium. It not only occurs in the British Isles and Europe, but also in North America. The parts of the flower in this genus are in fives (stamens ten), and the seeds have an elastic coat.

OXALURAMIDE or **OXALAN**, a substance obtained from alloxan; it is a white crystalline powder, insoluble in water, and having the formula $C_2H_5N_3O_3$.

OXAMIC ACID, an acid obtained from ammonium oxalate by dehydration. It is a white crystalline powder, soluble in water, insoluble in alcohol and ether. The formula is $C_2H_2NO_3$. It forms a number of salts called oxamates, having the general formula $C_2H_2MNO_3$. It melts at 173° C. (343° Fahr.), and decomposes into water, formic acid, and oxamide ($C_2H_2N_2O_2$), a white powder, soluble only in boiling water, which deposits it again on cooling.

OXENSTIERNA, AXEL, COUNT OF, a distinguished Swedish statesman, was born at Fanö, in Uppland, 16th June, 1583, of a noble Swedish family, and studied in Germany at Rostock, Jena, and Wittenberg, in which last university he took degrees. After his return to Sweden he was made a senator. When Gustavus Adolphus ascended the throne in 1611, he appointed him chancellor or prime minister. From that time his name is closely connected with that of his illustrious master, to whom his abilities as a statesman were of the greatest service. On the death of Gustavus at Lützen in 1632, Oxenstierna became the soul of the Protestant League in Germany, and his unflinching intrepidity and consummate skill proved the salvation of the Protestant cause at this momentous crisis. He succeeded in assembling the states of Lower Saxony at Heilbronn, and, after much opposition, was himself acknowledged as the head of the league. A succession of able commanders led on the Swedish and German forces, while Oxenstierna directed from Stockholm the diplomatic negotiations, until the peace of Westphalia, in 1648, put an end to the Thirty Years' War. Oxenstierna was at the head of the regency of Sweden during the minority of Queen Christina, and continued to be prime minister after she had assumed the government. He died at Stockholm 28th August, 1654. In the completeness of his moral and intellectual gifts Oxenstierna stands in the first rank among statesmen in the history of modern Europe.

OX'FORD or **OXON**, a midland county of England, is bounded N.E. by Northamptonshire; E. by Buckinghamshire; S.E., S., and S.W., by Berkshire; W. by Gloucester-

shire; and N.W. by Warwickshire. Its greatest length N. by W. to S. by E. is 51 miles; its greatest breadth is 28 miles. The area is 756 square miles, or 470,095 acres, and the population in 1881 was 179,650.

Surface, Geology, and Rivers.—The southern part of the county is occupied by the Chiltern Hills, which extend across the southern extremity from Buckinghamshire on the east to Berkshire on the south-west. These hills are composed of chalk, and form a portion of the extensive range of chalky elevations which extend through the counties intervening between Norfolk and Wiltshire, and which shuts in, on that side, the chalk basin of London. The Thames flows through a winding valley or depression traversing this chalk range. The Chilterns were formerly occupied by a forest or thicket of beech trees, which are best adapted to the soil. The chalk-marl, green-sand, gault, iron-sand, oolite, Kimmeridge clay, and lias appear at the surface in various parts.

Oxford is almost entirely comprehended in the basin of the Thames. The Stour, an affluent of the Warwickshire Avon, rises just within the north-western boundary; and the Ouse, in the upper part of its course, skirts the north-eastern border, and there receives one of its smaller tributaries; but the districts watered by these streams are too small to require detailed notice. The Thames, or, as it is sometimes called in the upper part of its course, the Isis, first touches the county a little below Lechlade in Gloucestershire, and leaves it near Henley. The Windrush, Evenlode, Cherwell, and Thame, affluents of the Thames, also belong to Oxford. The railways are connected with the Great Western and North-western systems.

Agriculture, &c.—The climate of Oxford is, on the whole, colder than its situation in the central part of the island would lead one to expect. The hilly lands in the north-western part are exposed and bleak; and the influence of the winds is only partially checked by the low stone walls which form the usual boundaries of the fields. The poorer chalky soils, also, on the slopes of the Chiltern Hills are late in bringing crops to maturity. But notwithstanding this circumstance, it may be reckoned among the most productive agricultural districts of England; and some of the land is of a quality which can scarcely be surpassed anywhere. The low lands in the valleys through which the rivers flow are in many places covered with the finest herbage, and maintain large herds of cattle.

According to the official agricultural returns published in 1885, the number of acres under cultivation was 417,733. Corn was grown on 150,000, green crops on 53,000, clover and other artificial grasses on 47,000, and 157,000 acres were permanent pasture. The number of cattle in the county at the same time was 55,000, and of sheep 290,000. Short horns are most in favour, but the dairy being considered of the greatest importance, every effort is made to procure the best milch cows, and hence there is a greater variety than in some counties. The sheep consist almost entirely of the Oxford Downs, an improved variety of the South Downs. The manufactures are not of much importance, being confined chiefly to blankets, gloves, and ale, and to a large agricultural implement manufactory at Banbury.

Oxford is divided into fourteen hundreds. It is in the diocese of Oxford, in the Oxford circuit, and the assizes are held at Oxford. The county returns three members to Parliament, the city of Oxford one, and the University of Oxford two.

History and Antiquities.—The county was probably divided between the two Celtic nations, the Catyuchlani and the Dobuni; of whom the former held the eastern and the latter the western parts. In the Roman division of the island Oxford was included in the province of Britannia Prima. Several ancient British or Roman roads crossed the county, and traces of Roman occupation remain at several places, especially at Dorchester and Stonefield.

In the time of Edward the Confessor Oxford was included in the earldom of Gurlth, the brother of Harold. It suffered severely from successive Danish invasions, and then enjoyed a long interval of peace. In 1387 the insurgent nobles defeated the Earl of Oxford and the royalists at Radcot Bridge; and in 1469 the rebels, under Robin of Redesdale, repulsed the army of Edward IV. under the Earl of Pembroke.

The county was the scene of several engagements in the Civil War—at Edgehill, 23rd October, 1642; at Chalgrove Field, 18th June, 1643; Cropredy Bridge, 1644; and Islip Bridge, 1645. In the latter the forces of the Parliament were successful.

Some fine examples of the later domestic architecture are extant in Oxford, especially the manor-houses of Stanton Harcourt, Mapledurham, Burford, Wroxton, Castleton, Fritwell, and Asthall. The principal castellated buildings are those of Oxford, Wallingford, Bannton, and Broughton. The chief ecclesiastical buildings are the churches of Oxford (the cathedral especially), Burford, Henley, Dorchester, Shiplake, Stanton Harcourt, and Witney. Of monastic remains there are few, and those not striking. Of Osney Abbey, once so magnificent, and of Godstowe Nunnery, near Oxford, the ruins are comparatively trivial.

OXFORD, a city and bishopric, municipal and parliamentary borough, and the capital of the above county, 63 miles north-west by west from London by the Great Western Railway, and 54 miles by the road, is situated on the left or north-east bank of the Isis or Thames, just above the junction of the Cherwell, which flows on the east side of the town. The Isis is divided at and near the town into several channels. The origin of Oxford is unknown. The name is probably derived from there having been a ford or passage for oxen across the Thames here; or is perhaps a corruption of Ouseford, the ford over the Ouse, which is supposed to have been the ancient name of the Isis.

The city is irregularly laid out, and the streets are well paved and cleansed. The police, which is regulated by the university and city authorities and maintained at their expense, is very effective. The public buildings, chiefly connected with the university, are numerous, and many of them striking from their magnitude, antiquity, or beauty. The whole aspect of the city is peculiarly picturesque, rivaling that of the most famous towns of mediæval Europe, with its mass of towers, pinnacles, and spires, rising among groves from the valley. The river glides quietly through meadows; dark and ancient buildings cluster together, forming avenues of edifices which elsewhere would pass for palaces.

On entering the city on the east side by the London road, over Magdalen Bridge, the buildings of Magdalen College present themselves on the north side of High Street. Immediately adjacent to the banks of the Cherwell, and opposite to Magdalen College, is the Botanic Garden. By the side of the river lies a tree-bordered meadow, belonging to the college, which is called Addison's Walk—the "Maudlin's learned grove" of the poet Pope. The Botanic Garden was first laid out in the early part of the seventeenth century. Queen's College is in High Street, which is a continuation of Bridge Street. Nearly opposite to Queen's, and close to University College, stand the new examination schools. On the same side of High Street as Queen's is All Souls' College. Down Catherine Street you proceed to New College, founded by William of Wykeham in 1380. Its gardens are among the most beautiful in Oxford. The opening from the High Street into Radcliffe Square presents numerous edifices of striking character. The eastern side is occupied by All Souls' College and the buildings of the former Magdalen Hall. On the western side stands Brasenose College. Between the east and west sides of the opening from High Street is St. Mary's Church,

forming the south side of Radcliffe Square. The Radcliffe Library is in the centre of the square. Opposite Hertford and All Souls' Colleges is the Bodleian Library, founded by Sir Thomas Bodley in 1618. Other benefactors have been the Earl of Pembroke, Archbishop Laud, Selden, Lord Fairfax, Sir Kenelm Digby, and Mr. Donn. It contains a large collection of priceless literary treasures. The picture gallery measures 129½ feet by 24½ feet from north to south, and 158½ feet by 24 feet from east to west. To the north of the Old Schools and the Bodleian Library lies an open square, the north side of which, towards Broad Street, is formed by the Clarendon, formerly a printing-office, a fine building of two storeys, 115 feet long, with a Doric portico, which was erected in 1711 from the designs of Vanbrugh. Near the Clarendon is situated the Sheldonian Theatre, built by Sir Christopher Wren; it is used for the more public or solemn assemblies of the university, and is calculated to hold nearly 1000 persons. The Museum, known now as the Ashmolean Museum, occupies a building adjacent to the theatre. Not far from the museum are Lincoln, Exeter, and Jesus colleges. In the park, behind the museum, an observatory was erected in 1877. On the north side of the town, near the parks, in Park Street, stands Wadham College.

The above-mentioned buildings are arranged according to their locality, proceeding from the London entrance into the centre of the town. The following are near the southern or Abingdon entrance, which is by a bridge over the arms of the Isis. Christ Church College is on the east side of St. Aldate Street. Adjoining the college is the cathedral of Christ Church, with a noble central tower. The length is 154 feet, width of the nave and aisles 54 feet, height of the nave 42 feet, and height of the tower 141 feet. Some antiquaries have ascribed the erection of this church to Ethelred II. (1002 or 1004); others, with better reason, fix it in the twelfth century. It was originally consecrated in honour of an ancient English saint, St. Frideswide. It was carefully restored by Dean Liddell in 1846. In Christ Church tower hangs the Great Bell of Oxford, mighty "Tom," weighing 17,000 lbs., and the clapper 342 lbs. It was brought from the Abbey of Osney, and re-cast in 1680. It is rung at five minutes past nine every evening.

In the same line of street with Christ Church College are the churches of St. Aldate, St. Martin, St. Michael, and St. Mary Magdalen. St. Giles' Church, a twelfth-century building, is in the same direction, but nearer the northern entrance of the town. An observatory is situated on the west side of the Woodstock Road, not far from St. Giles' Church, and nearer it is the Infirmary.

Balliol and Trinity Colleges are situated in Broad Street, near St. Mary Magdalen Church, as is also the Martyrs' Memorial, a very beautiful cross erected in 1841 to commemorate the death at the stake of Ridley, Latimer, and Cranmer for the "crime of heresy." The cross was designed by Scott after the model of Queen Eleanor's crosses. The actual scene of the martyrdom is supposed to have been in the Town Moat, called Canditch, and close beneath an old tower known as the Martyrs' Tower. St. John's College is close to the Memorial. Corpus Christi, Oriel, Merton, and Pembroke Colleges are near Christ Church College and the Cathedral. Worcester College is on the west side of the town. There are, besides the colleges, St. Edmund Hall, St. Mary Hall, intended to be absorbed into Oriel College, New Inn Hall, to be absorbed by Balliol, and St. Alban Hall (now absorbed by Merton), and Lady Margaret's and Somerville Halls for women. Of the churches, the most worthy of notice are St. Mary's and St. Peter's in the east.

Some remains are extant of Oxford Castle and of the ancient town wall, as well as of the works raised for the defence of the city in the Civil War of Charles I. The town and county hall is a spacious stone building; the

county goal is on the site of the castle. The other chief public buildings are the University Printing Office, the University Galleries, and the Taylor Institution. The galleries contain a fine collection of works of art, and the institution is devoted to educational purposes. There are several almshouses and school-houses, and places of worship for dissenters. A Roman Catholic chapel (St. Aloysius) was built in 1873. The buildings in connection with almost every college in Oxford have been restored and improved in modern times, and some very handsome edifices erected in many cases. Among the latter are the "New Buildings" in connection with Balliol College, and the Keble College, built in 1869 at a cost of £50,000, in memory of the author of the "Christian Year." To the latter a chapel hall and library were added in 1876-77. Just opposite Keble is the very handsome and well-appointed Natural History Museum.

Oxford is connected with London by the North-western and Great Western railways. There are no manufactures of consequence. The prosperity of the city depends mainly on that of the university, and on its being the mart for the surrounding agricultural district. The High Street of Oxford, about 1000 yards in length, is considered one of the finest in Europe. Considerable traffic is carried on, partly by land, partly by the river, or by the Oxford Canal, which joins it here. The municipal borough is divided into five wards, and is governed by a mayor, nine aldermen, and thirty councillors. The parliamentary borough formerly returned two members to the House of Commons, but was deprived of one by the Redistribution of Seats Act of 1885. The population in 1881 was 40,837.

Oxford (originally called *Ocenaford* or *Oxeneford*) lays claim to a very high antiquity. It suffered much during the ravages of the Danes, and was the residence of Canute, and of his son Harold Harefoot. William the Conqueror stormed the town in 1067. Soon after, the castle (remains of which are still existing) was built by Robert de Oligi, one of the Norman barons. Henry I. built a palace here, which continued to be a favourite regal residence during several successive reigns; but it was pulled down at the dissolution of the religious houses. Oxford had a share in the civil wars of Stephen and Henry II., which was terminated by a council held in it in 1154. The history of the city is henceforward closely connected with that of the university, which now began to attain a high celebrity. Hot disputes on points of scholastic doctrine prevailed between the reigns of Henry III. and Edward III., and in the middle of the fourteenth century a large body of the students removed to Stamford, in Lincolnshire. Pestilence at the same time made great ravages; the city was almost deserted, and the university all but ruined. The introduction of the doctrines of Wyclif, at the close of the fourteenth century, occasioned a great commotion in the academic body; the city suffered much during the Wars of the Roses, and Oxford was again visited by plague in the reign of Henry VII. The troubles of the Reformation, and the spoliation of the academic houses by Henry VIII., drove many of the students from their habitations; but that monarch may be said to have reinvigorated the university by the establishment of the Cathedral of Christ Church, as well as by the foundation of professorships for the learned faculties. Roman Catholicism was restored under Queen Mary, and during this period Oxford acquired an unenviable notoriety by the martyrdoms of the three great reformers, Cranmer, Ridley, and Latimer, in 1555-56. In the following reigns the city and university gradually recovered from their previous depression, and the latter received from James I. and Charles I. many important privileges. Oxford warmly espoused the cause of the royalists during the reign of Charles I., who made it his headquarters after the battle of Edgehill. For a lengthened period after the Revolution Oxford was attached to the party of the Jacobites. Among

the distinguished natives of the city have been, Edmund Ironside and Harold Harefoot (who died here); Richard Cœur de Lion; King John; William Chillingworth, the divine; Sir William Davenant, the poet; Anthony Wood, the erudite author of "Athenæ Oxonienses;" and Henry Martin, the regicide.

OXFORD CLAY, a thick bed of dark bluish clay, with calcareous sandstone (termed Kellaway's Rock) near its base, and classed with the overlying coral rag to form the Middle Oolite group. [See JURASSIC PERIOD.] This formation, which is so called from its typical development along the valley of the Isis in Oxfordshire, extends in a more or less continuous band of varying width from the neighbourhood of Weymouth in Dorsetshire to the coast of Yorkshire; and in Lincolnshire it bears the name of "fen clay," from its forming the base of that marshy district. It is sometimes as much as 600 feet in thickness, and is largely worked for the manufacture of bricks, tiles, pipes, &c. Fossils are abundant, including Ammonites, Belemnites, various Lamellibranchs, fishes, and remains of extinct reptiles of the genera Ichthyosaurus, Plesiosaurus, Metriorhynchus, and Megalosaurus. The most typical species are *Ammonites fusum*, with a peculiar projection from the mouth of the shell; and *Gryphea dilatata*, a kind of oyster having a closely ally in the Liassic strata.

OXFORD UNIVERSITY. The origin of the University of Oxford is unknown; but it is certain that Oxford was a place of study in the reign of Edward the Confessor, if not earlier. An interesting tradition (not supported by any evidence of value) attributes its foundation to Alfred the Great in 886.

The first places of education in Oxford appear to have been schools for the instruction of youth. These schools were either claustral, that is, appendages to convents and other religious houses; or secular, such as were kept by, or hired and rented of, the inhabitants of Oxford. When many of these secular scholars resided in one house, it got the name of Hall or Hostel (terms which are not yet out of use), and governors or principals were appointed to superintend the discipline and the affairs of the house. The schools were divided into grammar schools, sophistry schools, schools for arts, medicine or physic schools, law schools, divinity schools, &c. It is difficult to discover any traces of a regular plan of education in Oxford before the foundation of the first college by Walter de Merton. The statutes of this founder for his college are well digested; and they have been adapted, with little alteration, to succeeding times in other colleges as well as his.

In the reign of King Stephen, Vacarius, a Lombard by birth, established a school of Roman law at Oxford, which probably subsisted for some time after his death. The pupils of Vacarius were numerous, and as many of them were poor, he prepared for their use (about the year 1149) a work on Roman law in nine books, which was extracted from the Pandects and the Code. The learned John of Salisbury was the friend of Vacarius. (Savigny, "Geschichte des Römischen Rechts im Mittelalter," 4ter band; Wenck, "Magister Vacarius," Leipzig, 1820.)

The earliest charter of privileges to the University of Oxford is of the 28 Henry III. It was followed by charters, some of fresh privileges, and others of general confirmation of the privileges formerly granted, in the 39 Henry III., 1255; in the 18 Edw. III., 1344; in the 17 and 33 Edw. III.; in the 1 Henry V.; 37 Henry VI.; and 15 Henry VIII. The last confirmation was in the 13 Elizabeth.

The corporation of the university is styled "the Chancellor, Masters, and Scholars of the University of Oxford."

With the exception of rare interventions on the part of the crown, and of one interference on a large scale by Act of Parliament in 1854, the university has always been governed by statutes of its own making. A sort of council, devised probably by Archbishop Laud, was instituted in

1631 by King Charles I. It consisted of the heads of houses and the proctors, and from being appointed to hold a weekly meeting every Monday, became known by the name of the Hebdomadal Board. The business of this board was to deliberate on all matters relating to the maintenance of the privileges and liberties of the university, or to the due observance of its statutes and customs, and generally to consider and discuss every measure tending to the improvement or benefit of the university before such measure should be submitted for the approval of the whole academical body in Convocation assembled. It thus had the *initiative* in all the legislation of the university, and in fact no question of any sort could be submitted to the votes of Convocation without its sanction.

In this constitution of the university the Act of Parliament of 1854 made a considerable change. It left, or rather, it has been interpreted to have left, the two ancient assemblies of Congregation and Convocation, at which matters relating to the welfare of the university were discussed after they had been debated at the Hebdomadal Board; but it added a third, which is now called, in the terms of the Act, the Congregation of the University of Oxford; and it transferred all the "powers, privileges, and functions" of the old Hebdomadal Board to another body of persons called the Hebdomadal Council.

This new Congregation consists of certain high official persons, and of all those members of Convocation who resided within one mile and a half of Carfax (the recognized centre of Oxford, where four principal streets meet) for twenty weeks during the year which ended on the first of the previous September. The chancellor or vice-chancellor, with the proctors, preside at its meetings, as in the two ancient houses.

The Hebdomadal Council consists of some official and some elected members. The official members are the chancellor, the vice-chancellor, the late vice-chancellor, and the two proctors. The elected members are six heads of colleges or halls, six professors, and six other members of Convocation, who, however, may be heads of houses or professors, and the six professors may be heads of houses. These persons are elected by the Congregation of the University of Oxford for six years, in such a manner that one-half of each of the three classes vacate their seats every three years, being, however, capable of re-election.

The ancient House of Congregation has now no concern with legislation in any form, and its business is confined almost exclusively to the granting of degrees. When a student has passed all the examinations, kept all the terms, and reached the standing required by the statutes, and has obtained the *grace*, or permission, of his own college or hall, it is still necessary for him to *supplicate the grace* of this house in order to his admission to any degree. And when a *supplicat* (as it is called) is read out, every member of the house has the power to suspend the granting of the grace three times, in three distinct Congregations, without giving any reason for his negative; but after the third refusal he is required to state privately to the vice-chancellor and proctors the ground and proof of his objection, which are to be submitted to the judgment of the whole house at the next Congregation without any publication of the objector's name, and the question is then decided by a majority of votes, unless the vice-chancellor singly, or the two proctors jointly, should interpose the negative which is allowed to them officially on every matter proposed in Congregation. Should the grace be thus refused the fourth time, a full year must pass before the candidate can apply for it again. The actual suspension of a grace, however, is a thing now almost unknown, but the threat of it is said to be sometimes employed in order to compel payment of debts.

The business of the present Congregation of the University of Oxford, on the other hand, is confined almost exclusively to administrative details. Every statute ap-

proved by Congregation has to be submitted to Convocation after an interval of seven days, for final adoption or rejection.

In the House of Convocation, consisting of all masters of arts and all doctors of the three superior faculties who have their names upon the books of some college or hall, every formal act of the university, and all its business as a corporate body, except only what relates to the granting of ordinary degrees, is done and concluded. *Statutes* which have passed Congregation do not become binding enactments until they have received the assent of this assembly. *Honorary degrees* are given by consent of Convocation, and it is in this house also that eminent persons occasionally receive *degrees* conferred out of the ordinary course either *by decree* or by *diploma*. No proposition, however, whether general or special, can originate in Convocation itself, either as a substantive measure, or as an amendment to such a measure; nothing is brought forward here but what has been devised and approved by the Hebdomadal Council; and Convocation has only to accept it in the very terms in which it is proposed, or to reject it altogether.

For the better management of certain matters of administration or detail, Convocation often delegates its authority, or some limited portion of it, to a committee chosen from itself; and the persons selected for such committee are called *delegates*.

The officers of the university are:—

The *Chancellor*, who is elected by the members of Convocation. No stipend is assigned to this office; on the contrary, the custom of many years has entailed expenses on its holder. The honour is generally conferred on some nobleman of distinction—the present occupant being the Marquis of Salisbury.

The *High Steward*.—The Seneschallus, or High Steward, is appointed by the chancellor, and approved by Convocation. His special duty is to hear and determine criminal causes of the gravest kind, such as treason and felony, at the mandate of the chancellor, and according to the laws of the land and the privileges of the university, whenever the prisoner is a scholar or privileged person resident within the precincts of the university. There is also a Deputy Steward, appointed in like manner. The present High Steward is the Earl of Carnarvon.

The *Vice-Chancellor* is annually nominated by the chancellor from the heads of colleges. He appoints four deputies, or Pro-vice-Chancellors, from the heads of colleges, who exercise his power in case of his illness or necessary absence from the university. The office of late has been generally held for four years. The annual income is £600.

Proctors.—The two proctors of the university are elected out of the different colleges in turn from those members of the several societies who, being members of Convocation, are also or have at any time been members of the Congregation of the university, and all those fellows and scholars of a college who are members of Convocation. The election is made yearly. The proctors each nominate two masters of arts, of three years' standing at the least, to be their respective deputies or Pro-Proctors. The former receive an annual stipend of £350 each; the latter, of £80. The duty of the two proctors is to inspect the conduct of the members of the university as to all matters of discipline and good order.

Burgesses.—After several unsuccessful attempts on the part of the university to obtain from Queen Elizabeth permission to send burgesses to Parliament, the privilege of sending two was granted by King James I. by letters patent in 1604. All members of Convocation are electors. A special provision for the mode of election is the use of voting papers, which renders personal attendance at the polls unnecessary.

Assessor of the Chancellor's Court.—The chancellor

has jurisdiction in almost all causes, whether civil, spiritual, or criminal, in which scholars or privileged persons resident within the precincts of the university are parties. For its exercise a court is held every Friday during term, in which the vice-chancellor is the presiding judge, and the two proctors of the university may, if they please, sit as assessors. But for the better despatch of business, the vice-chancellor appoints some doctor or bachelor of civil law to sit with him as assessor and to act as judge for him in his absence. The annual stipend of such assessor is £10.

The other officers connected with the university are the *Public Orator*, whose business is to write letters and addresses and to make orations in the name of the university upon public occasions, to present those on whom the honorary degree of master of arts is to be conferred, and to deliver the annual Creweian Oration alternately with the professor of poetry: he must be a master of arts or a bachelor of civil law, and is elected by Convocation; the stipend is about £150 per annum: the *Clerks of the Market*, who have to secure fair dealing in provisions of all kinds—the most important part of their duty in the present day being the supervision of weights and measures: the *Keeper of the Archives*, who has charge of all the papers connected with the university; and the *Registrar*, who attends all meetings of the Heldomadal Council, of both Congregations, and of Convocation, and registers all acts to which the common seal of the university is affixed. The salary is £600 per annum.

UNIVERSITY TERMS.—There are four terms for academical exercises in each year; but for many professors' lectures, and some other purposes, the third and fourth together count as only one. (1) Michaelmas Term begins on the 10th of October, and ends on the 17th of December; (2) Hilary (or Lent) Term begins on the 14th of January, and ends on the day before Palm Sunday; (3) Easter Term begins on the Wednesday after Easter day, and ends on the Friday before Whitsunday; (4) Trinity (or Aet) Term begins on the day before Whitsunday, and usually ends on the Saturday after the first Tuesday in July, but may be continued beyond that day by Congregation. *Fall Term* begins on the Sunday after the first Congregation, that is, on the Sunday after the first day of term. Michaelmas and Hilary Terms are kept by six weeks' residence in each; Easter and Trinity Terms either by three weeks' in each, or by forty-eight days' residence in the two terms jointly. More than this is, however, required by some colleges, and twenty six weeks may be taken as the ordinary length of the academic year.

DEGREES CONFERRED BY THE UNIVERSITY.—The degrees conferred by the university upon students are those of Bachelor and Master in Arts, and of Bachelor and Doctor in Music and in the three superior faculties of Civil Law, Medicine, and Divinity. We shall, however, confine ourselves to the examinations necessary for bachelors and masters of arts, as the others are in a great measure formal.

The conditions required for degrees in the ordinary course are residence, time or standing (as it is commonly called), examination or exercises, and, at the time of taking a degree, payment of fees, subscription to Articles, and taking of oaths.

Twelve terms of residence are required for the degree of bachelor of arts and for the position of student of civil law or of medicine. No further residence is necessary for any degree. The conditions are, however, slightly modified in the case of privileged students, who consist of all peers; all sons and the eldest sons of all eldest sons of peers and of peeresses in their own right; all baronets and the eldest sons of all baronets and knights. All these students may be admitted to the degree after eight terms' residence, but not till their twelfth term after matriculation. Any such person is at liberty to renounce his privilege; and, indeed,

some of the best colleges will only receive such students on condition that their special privileges are waived. A bachelor of arts can proceed to the degree of master in the twenty-seventh term (if privileged, in the twenty-third) from his matriculation, provided he has had his name on the books of some college or hall for a period of twenty-six (or of twenty-two) terms. A master of arts may be admitted to the degree of bachelor of divinity at the end of seven years from his admission to regency. A bachelor of divinity may proceed to the degree of doctor at the end of four years from his admission to the degree of bachelor.

Examinations and Exercises for Degrees.—Candidates for the degree of B.A. are required to pass three distinct examinations—(1) responsions before the masters of the schools; (2) the first public examination before the moderators; (3) the second public examination before the public examiners.

1. *Responsions* are held four times every year, and are called the "Little Go" or "Smalls" by the undergraduates. Every candidate must be examined in Latin and Greek grammar, one Latin and one Greek author, arithmetic, and either Euclid or algebra. Every candidate who passes it to the satisfaction of his examiners receives from them a certificate to that effect, commonly called a *testamur*. It is necessary that the candidates should satisfy the examiners in the whole of the subjects, failure in any one being fatal to success.

2. *First Public Examination or "Moderations."*—This examination is held twice every year. Every candidate must be examined in Latin and Greek grammar, either in logic or in algebra together with three books of Euclid, in the four Gospels in Greek, and in one Latin and one Greek author at the least, of which one must be a poet and the other an orator, and neither of which may be the same with either of the two which he brought in for responsions, unless he now brings in as many as four authors. No moderator is allowed to examine any candidate from his own college or hall, or one who has read with him as a private pupil within the preceding two years. Candidates for honours in classics have to answer deeper questions in philology and criticism, and to translate from English into Greek as well as Latin. Their translations from Greek and Latin into English are to combine elegance with accuracy. They may be required to write verses both in Greek and Latin. The authors chosen by them must be chiefly poets and orators, especially Homer and Virgil, Demosthenes and Cicero. For the highest honours logic is indispensable. The examination for honours in mathematics is confined to pure mathematics. No one can obtain honours after the end of his tenth term. There are three divisions of honour in each school, the names of the candidates being placed alphabetically in each division; and the names of all the rest who pass the examination are printed in the same way.

3. *Second Public Examination.*—There are thirteen public examiners, divided among four schools: four in classics, three in mathematics, three in natural science, and three in law and modern history. Formerly two at least of these schools had to be passed before the degree of B.A. could be obtained; but with the view of inducing more candidates for degrees to read for honours, a statute was passed in 1864 by which they have since been required to pass through one school only, provided they have obtained a third class in some one school, and have taken up at least three books at moderations. As was anticipated, this change has proved very beneficial in its operation, as a man whose tastes lead him to some other line of study may, after a year and a half, give up classics and read for honours in something else—the reading for honours being a totally different thing from reading for a "pass." By a statute passed in 1869, a candidate for holy orders, after passing moderations, may, if he choose, in like manner

dismiss all secular studies, and confine himself entirely to divinity. The examination is held twice every year. In the classical school every candidate must be examined in divinity, and—with the exception just mentioned—in one Latin and one Greek author at the least. The term "divinity" comprises the Gospels and Acts of the Apostles in Greek, the history of the Bible, and the evidences of religion. The Thirty-nine Articles were also included until 1872. Candidates for honours may bring in one or more of the apostolic epistles, and any classical writers on history, rhetoric, the art of poetry, and ethical or political science; in connection with ancient history they are examined in chronology, geography, and antiquities; and they may be called upon to compose in Latin and Greek as well as in English. Logic is also indispensable. In the mathematical school every candidate must be examined either in the first six books of Euclid or in the first part of algebra. The subjects of examination for honours range over mixed as well as pure mathematics. In the school of natural science every candidate must be examined in the principles of two out of the three branches of natural science—mechanical philosophy, chemistry and physiology—and further in some one of the particular sciences dependent on mechanical philosophy. Candidates for honours must be examined in the principles of all the three branches of natural science named above, and are required to be well acquainted also with some one of the particular sciences which fall under one or other of them. In the school of law and modern history every candidate must offer himself for examination either in English history from the Conquest to the accession of Henry VIII., together with that part of English law which relates to things real, or in English history from the accession of Henry VIII. to the death of William III., together with that part of English law which relates to persons and things personal; being at liberty, however, to substitute Adam Smith's "Wealth of Nations," or some other approved work on political economy, together with the history of British India for either portion of English history, and Roman law for either portion of English law. For honours the subjects of examination are modern history as far as the year 1789, and jurisprudence.

Subscriptions and Oaths on taking Degrees.—No subscription or declaration or oath of any kind is required from any person upon being admitted to the degree of B.A. But inasmuch as there are certain offices, such as masterhips in grammar-schools, which must be held by members of the Established Church and for which the degree of B.A. is a qualification, it is provided that any person may, either when taking any one of those degrees or afterwards, subscribe to the Articles of the Church of England, and take the oath of allegiance and supremacy like other graduates. Before admission to the degree of master of arts, bachelor of divinity, or doctor of any of the three superior faculties, every person was formerly required to subscribe the Thirty-nine Articles, but this restriction was removed by the University Tests Abolition Act passed in 1871 (34 & 35 Vict. c. 26). Clause 3 of this Act enacts that no person taking any lay academic degrees, or holding any lay academic or collegiate offices, shall in future be required to subscribe to any formula of faith; but it also provides that no layman, or a person not a member of the Church of England, shall be eligible for an office hitherto restricted to persons in holy orders; nor shall it remove the obligation for those who fill such offices to enter holy orders, nor open offices hitherto filled only by members of the Church of England to persons not so qualified.

The professors of the university are, like those of Cambridge, paid from various sources; some from the university chest, others by the crown, or from estates left for that purpose. They are—the Regius Divinity, Regius Pastoral

Theology, Regius Hebrew, Regius Greek, Regius Civil Law, Regius Medicine, Regius Ecclesiastical History, Regius Modern History, Botany, Lady Margaret Divinity, Saville Astronomy, Radcliffe Observer, Saville Geometry, Natural Philosophy, Moral Philosophy, Candem History, Laud Arabic, Lord Almoner Arabic, Experimental Philosophy, Linacre Physiology, Poetry, Viner Common Law, Lord Lichfield Clinical Medicine, Rawlinsonian, Aldrich Chemistry, Mineralogy, Geology, Political Economy, Boden Sanskrit, Logic, Music, Dean Ireland Exegesis of Holy Scripture, Waynflete, Chichele International Law, and Chichele Modern History. Several of these professors give no lectures—a circumstance which is explained by the fact of some of the ancient studies of the university having fallen into disuse, civil law, for instance; but more particularly in consequence of the practical change which in the course of time has taken place in the system of teaching.

Since 1872 many of the professors and college tutors have combined in arranging a valuable series of lectures, to which all members of the united colleges are eligible; and this system has to some extent superseded the custom of coaching by private tutors.

Women, Examination of.—The foundation of colleges for women at Oxford has not unnaturally led to the hope that the university may, in process of time, be induced to recognize them as students on the same footing as men. At present no degrees are granted to women, but on 29th April, 1884, it was decided by a vote of Convocation, after much agitated discussion both in the university and the public press, that women should be permitted to be examined and placed in classes according to merit, by the same examiners and with the same papers as undergraduates of the university, in the honour schools of moderations, classical or mathematical, and the final honour schools of modern history, mathematics, and natural science. Candidates are at liberty to offer a part or section of the subjects of examination without being required to offer the whole, and the class lists made out are to be published, and certificates awarded by the examiners. It will be noticed that women are not examined in company with members of the university, nor awarded the university degree, nor are they as yet admitted to the honour school of literæ humaniores—the principal Oxford school—nor to the schools of law or theology.

The buildings belonging to the University of Oxford are:—

1. The *Schools*, with the *Bodleian Library*. See *BODLEIAN LIBRARY*.
2. The *Theatre*, built by Gilbert Sheldon, archbishop of Canterbury and chancellor of the university, in 1669.
3. The *Ashmolean Museum*, built at the charge of the university in 1683.
4. The *Clarendon*, completed in 1712, partly from the profits arising from the sale of Lord Chancellor Clarendon's "History of the Rebellion," the copyright of which was given to the university. The basement story of the Clarendon contains at present a police-room and other apartments connected with that establishment; the remainder of the building is appropriated to offices for the despatch of university business, and lecture rooms for the professor of experimental philosophy and the readers in mineralogy and geology.
5. *Radcliffe Library*.—The munificent founder of this library was John Radcliffe, M.D., who was born at Wakefield in 1650. By his will, 13th September, 1714, he appropriated £40,000 for the building and purchase of the ground on which it stands; £100 per annum for the purchase of books, and £150 per annum for the librarian. Gibbs was the architect. This library was opened 13th April, 1749. It has been appropriated by a resolution of the trustees to the reception of books in medicine and natural history.

6. *The Radcliffe Observatory*.—This building was erected out of the funds of Dr. Radcliffe by the trustees of his will.

7. *The University Press*.—As the great increase of business rendered it necessary to have more extensive premises, the delegates of the press were empowered by Convocation, in 1825, to contract for the purchase of ground north of Worcester College, for the erection of a new building. The present building was commenced in 1826 by Mr. Daniel Robertson. The entire front and the south wing were finished in 1827; the north, which was commenced in 1829 under the superintendence of Mr. Blore, was completed in the following year.

8. *The University Galleries* were erected partly from a legacy bequeathed by Dr. F. Randolph, and partly from moneys furnished from the funds of the university. They comprise galleries of ancient and modern sculpture.

9. *The Taylor Institution* consists of a spacious library, various lecture-rooms, and apartments for the residence of a librarian. It was erected in pursuance of the will of Sir Robert Taylor, the architect, for the study of modern European languages. The two last named were erected in 1812–45, at the angle of Beaumont Street and St. Giles' Street.

10. *The University Museum*, erected at the charge of the university for the promotion of the study of natural science, was opened in 1860. The valuable collection of scientific books which was formerly kept in the Radcliffe Library has, for the convenience of students, been removed here.

Besides these buildings, there is a *Botanic Garden*, containing about 5 acres, originally the burial-ground of the Jews in Oxford. The entrance gateway was designed by Inigo Jones.

The total number of members upon the books of the different colleges and halls of Oxford is generally about 7000. It is difficult to ascertain the actual number of students, but it is probably not above 1400. They are, of course, principally supplied from the great English schools; more especially from Eton, Rugby, Westminster, and Winchester. It is necessary to apply to the head of the college to which the student wishes to belong some time in advance; in fact, the places in all the good colleges are filled up for years beforehand. There is no university examination at matriculation, but the colleges compel every student to pass one before they receive him—the standard varying with the college. After being received each undergraduate is assigned to a college tutor, who exercises a special control over his reading; but he has the privilege of attending the lectures, and also of receiving instruction from other college tutors as his studies may require. The total cost of tuition varies at the different colleges, but may be fairly estimated at from £60 to £80, spread over three or four years. In addition to this, however, most students find it desirable to avail themselves of a private tutor before attempting to pass for their degree, and the usual charge of these gentlemen is £10 a term for three hours a week. The annual expense of a student varies from £100 to £300. Since 1868 such students as preferred it have been permitted to lodge in licensed private houses, instead of being compelled to reside within the colleges.

The following are the colleges of Oxford, with the dates of their respective foundations:—University College, the date of the foundation of which is uncertain, but which was restored before 1249; Merton, founded at Maldon, in Surrey, in 1264—removed to Oxford, 1274; Exeter, 1314; Oriel, 1326; Queen's College, 1340; New College, 1386; Lincoln, 1427; All Souls, 1437; Magdalen, 1456; Brasenose, 1490; Corpus Christi, 1516; Christ Church College, 1525; Trinity, 1554; St. John's College, 1556; Jesus College, 1571; Wadham, 1613; Pembroke College, 1621; Worcester,

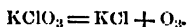
1714; Keble, 1868; St. Edmund Hall, soon after 1269; St. Mary's Hall, 1333; New Inn Hall, 1392; Magdalen Hall, 1487; St. Alban's Hall, soon after 1547. The colleges will be found described under their respective names.

Altogether, the colleges have at their disposal about 360 fellowships, 350 scholarships and exhibitions, and the patronage of 460 livings; exclusive of the fellowships, prizes, &c., in the gift of the university. The Universities Commission, which reported in 1874, found that the annual revenue of Oxford university was £17,000, and of its colleges and halls, £366,000. The result of this inquiry clearly showed that the revenue of the university was not adequate to the full discharge of the duties incumbent on it, and an Act of Parliament was accordingly passed in 1877, with the object of enabling or requiring the colleges to contribute more largely out of their revenues to university purposes—especially with a view to further and better instruction in art, science, and other branches of learning.

OX'US, the Jihun of the Arabs, the Amu-darya of the Persians, and the Vak-shu of the Hindus, is a river of Central Asia, in Turkestan, draining the Great Pamir through two head streams—the Panja or southern, rising in Lake Victoria, 13,900 feet above the sea-level, and the Ak-su or Murghab, or northern, said to flow from Lake Barkal Yasin, 12,000 feet above the sea level, and receiving the outflow of Lake Kara-kul above the junction. The united stream flows first westwards towards Balkh, before reaching which it gradually trends to the north-west until, after a course of about 1300 miles, it reaches the south coast of the Aral Sea. In parts the stream has a breadth of 800 yards, with a depth of 20 feet, and a very rapid current; but the vast quantity of sedimentary matter which it brings down to the mouth, forming shifting sands and banks, renders it difficult to navigate. A great portion of the volume of the stream is absorbed in the irrigation of the Khivan Oasis. The tendency of the Oxus, like that of the great Siberian rivers, is to press continually on its right or east bank, and twice within historic times it has oscillated between the Caspian and Aral Seas. In the fourteenth century it is supposed to have entered the Caspian by the Uzboi channel, near Mikhailovsk. It was proposed at one time to attempt to reopen this bed, but the scheme has been abandoned in favour of the steppe river, Chagan. Herodotus seems to refer to the Oxus under the name of Araxes, but his description is confused, and many commentators suppose that the Araxes of Herodotus is the river of the same name in Armenia; while others suppose that it is either the Volga or the Jaxartes. Strabo says that the Oxus rose in the Indian mountains and flowed into the Caspian, which is also the opinion of Mela and Ptolemy. Pliny makes it rise in a lake called Oxus, and the truth of his statement is now confirmed.

OX'YGEN. This important elementary body is the most abundant of all the elements. In combination with hydrogen it forms the water we drink; diluted with nitrogen it constitutes the air we breathe; and in combination with calcium, as lime, silicium, as sand, and aluminium, as clay, it forms a large portion, estimated at one-half, of the earth's surface; nearly all minerals contain it, and it is necessary to the growth and life of all organic bodies, animal and vegetable. It was discovered by Priestley in 1774, who called it dephlogisticated air. The name of oxygen was given to it by Lavoisier, who regarded it as the sole cause of acidity. Priestley first obtained it from the binoxide or red oxide of mercury by heating it; the whole of the combined oxygen is given off and the metal is reduced. The usual method adopted in the preparation of oxygen for lighting or other commercial purposes, is by heating potassium chlorate mixed with an eighth part of peroxide of

manganese, in an iron bottle; those imported with mercury are often employed. The chlorate is reduced to chloride, and the oxygen liberated, as in the following reaction—



The oxide of manganese is not necessary, but it prevents the salt from fusing, and evolves the gas at a lower temperature. Peroxide of manganese alone, when heated to redness, forms a cheap source of oxygen. It is reduced to the sesquioxide.

Oxygen can be obtained from many highly oxidized bodies, such as permanganate and bichromate of potassium, peroxides of lead and manganese, by the action of sulphuric acid, and these are all employed in various chemical processes of oxidation.

The most promising method of producing this gas on the large scale economically is that of obtaining it from the air by the action of peroxide of barium. When strongly heated this substance gives up half its oxygen and forms baryta ($\text{BaO}_2 = \text{BaO} + \text{O}$). The baryta thus formed is exposed to a current of steam and air and gently heated; the oxygen of the air is absorbed and the peroxide again produced, the process thus being continuous. Much time has been spent in perfecting this process, and it is now worked on a pretty large scale in Paris, producing oxygen at a low cost. There are several metallurgical operations for which cheap oxygen would be a desideratum; at present it is principally employed in the free state for the lime light used for exhibition, lecture illustration, and theatrical purposes, and for the oxyhydrogen furnace employed in the melting of platinum and iridium.

Oxygen is a colourless, tasteless, and inodorous gas. It is heavier than air, having a specific gravity of 1.1056. The symbol is O, the atomic weight 16. It is soluble in water to the extent of 3 per cent. by volume, and nearly all waters contain it in solution. The oxidation of organic matter and sewage in flowing rivers is due to this constituent. It forms water in combination with hydrogen, in the proportion of eight to one by weight and two to one by volume, contracting to two volumes. The combination with hydrogen takes place with explosive force, and is attended by a development of heat estimated by Bunsen at 2841°C , a temperature at which platinum is easily melted and silver distilled. In air it exists in the free state, diluted only with nitrogen, not combined, in the proportion of one volume to four of nitrogen. It can be respired, and supports life longer than an equal volume of air; hence the name vital air has been given to it. With the exception of fluorine it combines with every known element. Some burn with great brilliancy in it, such as phosphorus, carbon, sulphur, iron, zinc, and other metals. Even crystallized forms of carbon, as the diamond and graphite, burn in it with great intensity. Indeed, if the atmosphere consisted entirely of this gas most of our ordinary implements would become energetic fuels. Oxygen was long supposed to be incapable of liquefaction, but Cailletet and Pictet succeeded in liquefying it in 1877; they experimented on a very small quantity, and employed the extreme pressure of 300 atmospheres, or 4500 lbs. on the square inch. This has since been shown to be unnecessary; a pressure of sixty atmospheres, or 900 lbs. on the square inch, is sufficient, if combined with extreme cold. Liquid ethylene, which boils *in vacuo* at 150°C . (238°Fahr.) below zero is the refrigerator employed. At this temperature and pressure nitrogen, and therefore atmospheric air, can also be easily liquefied in considerable quantity. Liquid oxygen boils at -184°C . (-299°Fahr.) Phosphorus and many metallic compounds absorb oxygen from the air at ordinary temperatures. Iron, zinc, lead, and some other metals are unaffected in dry oxygen, but if moisture is present they are covered with a layer of oxide. Solution of white indigo absorbs oxygen, becoming blue. Pyrogallal acid in alkaline

solution also absorbs oxygen, and is employed for estimating and separating it from other gases. Oxygen occurs also in a particularly active form known as Ozone.

Oxygen forms, with the metalloids and metals—alkalies, as potash and soda; alkaline earths, as baryta, strontia, and lime; oxides, as oxides of iron, zinc, copper, lead, &c.; and acids, as sulphuric, nitric, phosphoric, &c. Many metals form oxides with a certain proportion of oxygen, and acids with a larger proportion, as ferric oxide and ferric acid, chromic oxide and chromic acid, manganic oxide and manganic acid.

OXYPHENIC ACID or PYROCAT'ECHIN. A substance obtained from catechin by dry distillation; it is also found in wood vinegar. It crystallizes in shining scales, which melt at 116°C . (240°Fahr.), and sublime unchanged. It is soluble in water and alcohol, but not in ether. The formula is $\text{C}_{12}\text{H}_6\text{O}_2$.

OXYPICRIC or STYPHNIC ACID, an acid obtained by the action of boiling nitric acid on extract of logwood, and also on some gum resins, as asafetida and galbanum. It crystallizes in yellow six-sided prisms; it is soluble in water, alcohol, and ether; the solutions dye the skin a permanent yellow. It is inflammable, burning with a bright-yellow flame. The formula is $\text{C}_{12}\text{H}_6\text{N}_2\text{O}_8$ or $\text{C}_6\text{H}_3(\text{NO})_3\text{O}_2$. It is a strong acid, and dibasic, forming two series of salts, neutral and acid, called oxyphates, and having the general formula $\text{C}_6\text{H}_3\text{M}(\text{NO}_2)_3\text{O}_2$ and $\text{C}_6\text{H}_3\text{M}(\text{NO}_2)_2\text{O}_2$. All are soluble and crystalline.

OYER (Lat. *audire*) AND TERMINER. These words, in ancient law-French, denote a commission which establishes a court of criminal judicature, the distinguishing character of which is described by them. The substance of the commission or *verit*, as it was anciently called, is an authority given by the king to certain persons to *hear and determine* (oyer et terminer) certain specified offences. The commissions of oyer and terminer are the most comprehensive of the several commissions which constitute the authority of the judges of assize on the circuits. The inquiry is by means of the grand jury. After the grand jury has found the bills submitted to it, the commissioners proceed to hear and determine by means of the petty jury. Justices of oyer and terminer at the assizes have, by the terms of their commissions, jurisdiction to inquire into the truth of all treasons, misprisions of treason, felonies, and misdemeanours committed within the several counties and places which constitute their circuits, and also to *hear and determine* the same on certain days and at certain places to be appointed by themselves. Besides these ordinary courts of oyer and terminer at the assizes, special commissions of oyer and terminer are sometimes issued upon urgent occasions where offences of a dangerous tendency have been committed in particular districts, and where the public peace and security require immediate inquiry and punishment.

OYSTER (*Ostrea*) is a genus of molluscs belonging to the class LAMELLIBRANCHIATA and order Asiphoniata. The shell of the oyster is irregular, and closed by a single large adductor muscle, centrally placed. The valves are unequal and laminated, the left valve, by which the oyster adheres to foreign bodies, being larger and convex, while the right and upper valve is flat and thin. The hinge is weak and without teeth, the valves being held together by a ligament. The foot is quite rudimentary and useless as an organ of locomotion. Oysters are hermaphrodite, but the sexes alternate, the genital organs producing at one time ova, at another spermatozoa, so that self-fertilization is impossible. An enormous number of eggs are produced by each individual, the average number probably being over 1,000,000. The eggs are fertilized in the genital duct; they pass out of the genital aperture and accumulate in vast numbers among the gill-plates (in the European oyster, *Ostrea edulis*), forming a creamy mass

known as white spat. The oyster in this condition is said to be "sick." The embryos are incubated, as it were, between the gill-plates, and in the course of a few days become Trochophores, ciliated, spherical larvae. At this stage, being about $\frac{1}{10}$ inch in diameter, they escape from the parent oyster and swim freely near the surface of the sea, exposed to be carried by the currents to a great distance from the place of their birth. They pass through further changes while in the free condition, and after several days (the exact time is unknown) sink to the bottom of the sea, and fix themselves to pieces of rock, stones, shells, &c., where, if not interfered with, they remain sessile for life. A muddy bottom is fatal to the young oyster. In the first year the shell is $1\frac{1}{2}$ inches in diameter, in the next year about $2\frac{1}{2}$ inches, and in the third year it grows to about 3 inches, after which the growth is much slower. Oysters are said sometimes to attain an age of twenty or twenty-five years. The food of the oyster consists of minute organisms, animal and vegetable, which are brought by currents into the gills, so that it is essential that the valves of the shell should gape slightly. The enemies of the oyster are rather numerous. The common star-fish grasps the shell in its rays and protrudes its stomach between the valves, engulfing the oyster. Another deadly enemy is the dog-whelk, which bores into the shell with the teeth of its lingual ribbon and sucks out its victim. In the larval state vast numbers are destroyed by fish and other marine animals.

The species of the genus *Ostrea* are numerous, nearly 100 having been described from temperate and tropical seas all over the world. They do not inhabit water of great depth, and some of the species are found in estuaries; but, according to Professor Huxley, oysters do not flourish in water containing less than 3 per cent. of salt. The Mangrove Oyster (*Ostrea parasitica*) is found adhering to the roots and branches of the mangroves in swamps within reach of the tide. The Common Edible Oyster of Europe (*Ostrea edulis*) is distinguished from the American Oyster (*Ostrea virginiana*), and the Portuguese Oyster (*Ostrea angulata*), by its habit of incubating its spat; in the case of the two latter artificial fertilization has been found possible.

As an article of food the oyster has always been held in high estimation, and some of the finest in the world are found on the British coast. These at Richborough in Kent, the ancient *Rutupiam*, were greatly valued by the Romans, who imported them at enormous expense. Oysters differ in quality according to the different nature of the soil or bed. Thus the best British oysters are found in the Thames, near Purfleet; the worst at Liverpool. A good quality is reared in the Medina River, Isle of Wight. When raised in artificial beds they are called "natives," and these fetch the highest price in the markets. The rearing of oysters now forms, both in Britain and France, an important branch of national industry. The chief British oyster beds lie off Whitstable, on the Kentish, and Colchester, on the Essex coast, different breeds being transported to these localities from Hampshire, Dorsetshire, and other maritime counties, and allowed to flourish on "beds" or "layings" in creeks along the shore, for two or three years, until they have attained the requisite flavour and dimensions. The oyster season lasts from 1st September to the end of April, or, according to a popular saying, oysters are good in every month with an *r* in its name. The chief centre of the American oyster trade is Baltimore, from which city enormous quantities of oysters are annually forwarded in a raw state to all parts of the country, or exported in hermetically-sealed tins.

Oyster culture, first practised, according to Pliny, by Sergius Orata, has reached an elaborate stage at Arcachon, Morbihan, and other artificial beds in France. The great objects of the oyster-culturist are first to catch the larvæ,

most of which would otherwise perish; next to transfer them, when caught, to a favourable place; and there to protect them from their natural enemies while they grow to marketable size. To secure these objects a "park" is made in a tidal estuary, and mature oysters laid down to produce "spat." Tiles covered with whitewash are laid down as "spat-collectors" and prove most successful. The young oysters, when about half an inch in diameter, are removed from these tiles and placed in "claires," tidal reservoirs, in which they grow and fatten. The peculiar green colour of some oysters, especially those from the artificial beds of Marennes, near La Rochelle, is thought to be due to the abundance of green *Conferve* in the water in which they live. Since in the case of the European oyster artificial fertilization is impossible, artificial beds ultimately depend on the preservation of the natural beds.

Within the twelve or fourteen years previous to 1877 the price of oysters increased about 600 per cent.—great scarcity having been caused in the United Kingdom, partly by over-dredging and so reducing the stocks, and partly by the wholesale and reckless removal at all times and seasons of the small spat and brood of the oysters. Under a strong apprehension that the extermination of the oyster fishery was becoming only a question of time, a parliamentary committee was appointed in 1876, whose report afforded a valuable mass of information on the subject of the oyster culture. The committee recommended that a close time be adopted, and most stringently guarded, during the breeding-season, from 1st May to the 1st September. This was not exactly adopted by Parliament, but an Act was passed in 1877 prohibiting the sale of "deep-sea oysters" between 15th June and 4th August, and of all other kinds between 14th May and 4th August. The Board of Trade were also empowered to prohibit dredging in any oyster bed for any time not exceeding a year after public inquiry and notice.

Professor Huxley insists strongly on the utility of establishing a close time for four months in the year, when, during the other eight, it is possible to clear an oyster-bed of its oysters. A close time, to be of any good, must be on the lines of that established for the salmon fishery, which means interference with the extent of possible capture throughout the year. But Professor Huxley considers that the conditions of the oyster's struggle for existence are so complex that legislation is of little practical use, and that human efforts must confine themselves to providing an abundance of young and keeping off as far as possible the oyster's enemies.

OYSTER-CATCHER or **SEA-PIE** (*Hæmatopus*) is a genus of sea birds belonging to the Plover family (*Charadriidae*). The Common Oyster-catcher (*Hæmatopus ostralegus*) is widely distributed along the shores of Europe, and is found in Iceland and North Asia; it winters on the northern shores of the Black Sea and the Caspian. It is found on the coasts of Britain and Ireland throughout the year, and stray specimens are frequently killed far inland. This bird is remarkable for the form of its bill, which is longer than the head, straight, strong, with the point much compressed and abruptly truncated. Its food consists of molluscs, crustaceans, and marine worms. With its wedge-like beak it is said to be able to remove limpets from rocks and open the shells of mussels; but in this country at any rate it does, as its name suggests, feed on oysters. The oyster-catcher is about 16 inches long. The plumage of the upper parts and neck is black, mingled with pure white, which is the colour of the under surface. The bill is orange red. The eggs are deposited in a slight hollow, either on the shingly beach or not far from the sea; they are three in number, of a pale cream colour, with spots of ashy gray and dark brown. The oyster-catcher is not esteemed for the table.

Several other species of the genus *Hæmatopus* have been described, all agreeing generally in habit with the common

species. *Hematopus palliatus* is found in North America, from Labrador to Florida.

OZENA (Gr. *ozo*, I smell), a discharge of purulent or fetid matter from the nostrils. This is usually a symptom of ulceration of the membrane lining of the nostrils or of caries of the adjacent bones, and accompanies cancerous, scrofulous, or syphilitic affections of the nasal organs. Such a discharge, however, must not be confounded with that slighter evacuation consequent upon severe and long-continued cold in the head, scarlatina, or erysipelas. The treatment must be both constitutional and local. In the strumous variety the administration of tonic medicines, such as cod-liver oil, quinine, iodide of iron, and arsenic, seem to be of most service. Those cases which are plainly syphilitic are best treated by bichloride of mercury or iodide of potassium where the patient possesses sufficient strength of constitution.

Local treatment consists in the removal of all sources of irritation by washing out the nostrils by means of the nasal douche or a syringe. The fluid used must depend upon the nature of the case, and may consist either of a simple saline, an antiseptic, or even a mercurial solution. Where the ulcerations can be reached they may be touched with a brush steeped in a solution of nitrate of silver, nitric acid, carbolic acid or other escharotic, and the opposed surfaces kept from contact by sponge tents or laminarin. In strumous ozæna the injection of glycerine, either alone or combined with iodine in the proportion of a grain of the latter to every ounce of the former, is often very beneficial.

OZARK MOUNTAINS, an extensive mountain region in the United States of North America, west of the Mississippi. They occupy more than half the state of Arkansas, and a considerable portion of the state of Missouri, south of the river Missouri. Their northern extremity forms the elevated shores of the Missouri between the mouths of the rivers Osage and Gasconade, where the Missouri begins to run eastward. The mountains extend S.S.E. from the banks of the Missouri to the banks of the Arkansas, which may be considered as breaking through the region. South of the Arkansas a mountainous country extends as far as the Red River. This mountain region extends S.S.W. to N.N.E. from the Red River to the Missouri, more than 350 miles. If the country about the upper branches of White River, which is covered with high hills, is considered as a portion of the Ozarks, their width from west to east cannot fall short of 100 miles. Thus the Ozarks cover a surface of rather more than 36,000 square miles, between 90° and 97° W. lon., and between 34° and 39° N. lat. They do not exceed 2000 feet in elevation.

OZOKERIT (Gr. *ozo*, to smell, and *keras*, wax) is a member of the paraffin group of compounds occurring in nature. It is greasy, having a wax-like appearance, and either colourless or stained somewhat with various impurities, which render it greenish, yellowish, or brownish. At Urpeth Colliery near Newcastle-on-Tyne, and at Uphall in Linlithgowshire, it is found in small nodular masses, but not in sufficient quantity to make the deposits of any commercial value. It occurs abundantly in Moldavia, at various localities on the flanks of the Carpathians, associated either with coal or other bituminous deposits, and is sometimes found in masses of from 80 to 100 lbs. in weight. The same hydrocarbon can also be obtained by destructive distillation of coal, petroleum, &c., and is employed in the manufacture of candles. The candles made from ozokerit are harder than those made from ordinary paraffin, and they give a brighter light in burning. In the refining process a certain proportion of soft paraffin is removed, and some heavy and light oils are obtained which have a similar commercial value to the corresponding products from shale and petroleum. Ozokerit is also used somewhat largely as an adulterant of beeswax.

O'ZONE. Many years ago the attention of chemists and electricians was drawn to the peculiar odour perceived when a powerful electric machine is at work, and with greater intensity on a spot which has just been struck by lightning. It was next observed that a similar odour, vaguely described as being sulphurous, phosphoric, &c., was elicited during certain chemical operations, and various theories were entertained concerning its nature. Some supposed it to be an allotropic variety of the peroxide of hydrogen; others, a teroxide of hydrogen. Schoenbein, who devoted much time to the investigation of this mysterious substance, and who named it *ozone*, considered it an allotropic variety of oxygen. This element he considered to exist under three forms—ordinary inactive oxygen, negative active oxygen or *ozone*, and positive active oxygen or *antiozone*. Further experiments have, however, shown that antiozone is nothing more than peroxide of hydrogen. It has been proved, in the first place, that *ozone* is denser than ordinary oxygen—being, in fact, half as heavy again. The production of ozone is always followed by a contraction of the gas's volume, the contraction being greater or less according to the amount of oxygen which has been ozonized. It is probable that ozone may consist of three volumes of oxygen condensed to two, for when it is absorbed by mercury one-third is taken up and removed, but the gas occupies the same volume. Some of the properties of ozone, too, are perfectly distinct from those of oxygen. Its power of oxidizing or rusting metals, for example, is much greater than that of oxygen. Many metals which oxygen will not oxidize at all, even when they are at a high temperature, submit at once to the influence of ozone. But the power of ozone on other substances than metals is equally remarkable. Its oxidizing power is such that gutta-percha and india-rubber tubings are destroyed by merely conveying it.

The bleaching and disinfecting powers of ozone are very striking. Schoenbein was at first led to associate them with the qualities of chlorine gas; but he soon found that they are perfectly distinct. Ozone is usually prepared by passing a current of air over sticks of phosphorus kept moist with water; it is always produced when electric discharges occur in air. It also accompanies the evaporation of water, and it is probably from this source that atmospheric ozone is obtained. Turpentine and other essential oils also afford it in air, and hence the value of these substances as disinfectants, and the presence of ozone in pine forests. Its presence is easily detected in the atmosphere by "ozone papers," or papers dipped in starch paste and potassium iodide. The ozone liberates the iodine which, acting on the starch, turns the paper blue; the amount is measured by the intensity of the colour. It is also absorbed by mercury and silver, and decomposed at a temperature of 250° C. (482° Fahr.) It bleaches most vegetable colours. Moist silver is converted into the peroxide; this is characteristic. In some cases, however, it acts as a deoxidizing agent. It decomposes peroxide of hydrogen and peroxide of barium, with evolution of inactive oxygen. It is slightly soluble in water, to which it imparts its peculiar odour and its power of oxidation. It has recently been condensed, forming an indigo-coloured liquid. Ozone is employed commercially in the bleaching of old engravings, and in the manufacture of aldehyde from alcohol, for use in making aniline greens. If it could be easily and cheaply manufactured and preserved on the large scale, it would become an important bleaching agent for general use. It decomposes the products emanating from putrefying matter more effectually than any other known element, and in thus acting as a disinfectant it is transformed into oxygen. It follows, then, that where there has been much work for ozone to do, there we shall find little ozone left in the air. Hence, in open spaces where there is little decomposed matter, we should expect to find more ozone

than in towns or cities. This accords with what is actually observed. And not only is it found that country air contains more ozone than town air, but it is found that air which has come from the sea has more ozone than even the country air, while air in the crowded parts of large cities has no ozone at all, nor has the air of inhabited rooms.

So far as we have gone, we might be disposed to speak unhesitatingly in favour of the effects produced by ozone. But there is a reverse side of this picture, for Dr. Richardson found that, when the air of a room was so loaded with ozone as to be only respirable with difficulty, animals placed in the room were affected in a very singular manner. "In the first place," he says, "all the symptoms of nasal catarrh and of irritation of the mucous membranes of the nose, the mouth, and the throat were rapidly induced. Then followed free secretion of saliva and profuse action of the skin—perspiration. The breathing was greatly quickened, and the action of the heart increased in proportion." When the animals were suffered to remain yet longer within the room, congestion of the lungs followed, and the disease called by physicians "congestive bronchitis" was set up.

The latest researches on the subject are those of Messrs. Dewar and McKendrick, of Edinburgh. Their conclusions,

after a series of elaborate and careful experiments, were that (1) The inhalation of an atmosphere highly charged with ozone diminishes the number of respirations per minute. (2) The pulsations of the heart are reduced in strength, and the heart is found beating feebly after the death of the animal (experimented on). (3) The blood is always found in a venous condition in all parts of the body, both in cases of death in an atmosphere of ozonized air and of ozonized oxygen. (In this particular the action resembles that of carbonic acid.) (4) Ozone exercises a destructive action on living animal tissues if brought into immediate contact with them. (5) Ozone acts as an irritant to the mucous membrane of the nostrils and air passages, as all observers had previously remarked.

The results of these experiments, therefore, seem to prove that what are known as the "ozone periods," though characterized by the absence of certain diseases, bring with them their own forms of disease. Apoplexy, epilepsy, and other similar diseases seem peculiarly associated with the ozone periods, inasmuch that 80 per cent. of the deaths occurring from them take place on days when ozone is present in the air in larger quantities than usual. Catarrh, influenza, and disorders of the bronchial tubes, are also affected by the ozone periods.

P

P (in Hebrew *pe*, the month, the sign **p** being originally a rude design of the mouth, the upright serving as the neck) is one of the letters in the "labial" or lip-made series, *m*; *b*; *p*; *v*; *f*; and any language having one of the series usually has all or most. They are respectively distinguishable as the nasal, the sonant and surd mutes, and the sonant and surd spirants—*p* being the surd mute labial. The remarks in the article on the letter *b* apply in great part to *p*, and need not therefore be repeated. See *B*.

In the old fashioned language of Phonology *p* is the *tenuis* or "thin letter" of the labial series. This letter is interchangeable with all the labials and with some others. Thus:—

1. *P* is convertible with *m* (see that article).

2. *P* with *b*. The *p* in Latin words often becomes a *b* in the related languages. Thus *apicula*, the diminutive of *apis*, a bee, is in French *abeille*; *septem* is in German *sieben*; modern English *lobster*, *drizzle*, *cobweb*, are from Old English *lappastre*, *driþ*, *copweb*. In Latin, the written *b* may have been pronounced as a *p* in the prepositions *ab*, *ob*, which correspond to the Greek *apo*, *upo*, *epi*. See also the article *B*.

3. *P* with *v*. This change is more particularly to be observed in the derivation of French from Latin. Thus from *capillus*, *episcopus*, *decipere*, *Aprilis*, the French have *chereu*, *evêque*, *décider*, *Avril*, &c. We have *kuare* from the Old English *cnapa*.

4. *P* with *f*. Two or three examples are given under *F*. To these may be added *pro*, *for*; *pater*, *father*; *piscis*, *fish*; *pauci*, *few*; *lupus*, *wolf*; in French *caput*, *chef*; &c.

5. *P* with *pf*. The latter form is often preferred by the German where our own tongue has the single letter. Thus the English words *pound*, *peach*, *pepper*, *peacock*, *apple*, are written by the Germans, *pfund*, *pfirsiche*, *pf Pfeffer*, *pfau*, *apfel*.

6. *P* interchanges readily with *c*, *k*, or *q*, especially as between Greek and Latin. See *C*.

7. *P*'s with *sp*. This change it will be more convenient to consider under the letter *S*. It may here be said that the frequent *ps*, *pn*, *pt*, of the classical tongues lose their *p* in French, as *psiana*, *pneuma*, *scriptus*, which become

lisane, *neuma*, *écrit*. The Greek *ph* becomes in Italian *f*, as *filosofia*, *fantasia*; in French occasionally so, as *faisan*, from *phasianus* (pheasant).

8. *Pi* before a vowel with *ch*. Thus *sapiam*, in Latin, becomes *sache* in French. The word *roche*, too, was probably formed from a barbarous Latin word, *rupia*; and *Ratupium*, in the county of Kent, appears upon this principle to have changed its name to *Rich-borough*.

9. *P* is occasionally inserted next *m* by sympathy, especially between *m* and *t*; thus *empty* is in Old English *emtig*; *tempt* is from Latin *tentare*; *redemption*, &c., have even already in their Latin form an interpolated *p*; and so also *glimpse*, *sempstress* (from *gleam*, *seum*).

In contraction *p* stands, in music, for *piano*, "soft;" *pp* for *pianissimo*, "very soft;" *mp* for *mezzo piano*, "moderately soft," &c. In commerce *p/p* means promissory note; *p/c* means per cent.; *p/p* or *per pro* means "per procurator," as when a clerk signs "per pro" his master by the latter's order; *p/p* also occasionally means "please pay;" *p/po* means postal order, *p.o.o.* post office order. *P.M.* (post meridianum) stands for "afternoon;" *p.p.c.* for "pour prendre congé" (to take leave, when leaving "goodbye cards"); *p.s.* for postscript.


PA'CA (*Cataglyphis paca*) is a South American rodent, belonging to the same family as the AGOUTI (*Dasyprocta*). The *paca* is an animal of considerable size, and of a heavy clumsy figure, having a thick muzzle, with the upper lip deeply cleft, a broad head, prominent eyes, rounded ears, and stout limbs, of which the hinder pair exceed in length the anterior; but as the greater portion of the tarsus rests on the ground, the body sinks even lower at the haunches than at the shoulders. The fore feet have five toes, of which the innermost is a mere rudiment, seated high and furnished with a small claw; the hind feet have also five toes, but of these the outermost on each side is small and seated high. The three central toes are large, strong, and furnished with powerful hoof-like nails. The tail is a mere tubercle. The body is clothed with short, coarse hair, yellowish-brown above and white beneath; the sides are marked with four or five longitudinal bands of white spots. The total length of head and body is about 2 feet.

These animals are natives of Central and South America, from Guatemala to Paraguay. Forests in the vicinity of water, wooded marshes, and the borders of rivers are their favourite localities. They excavate superficial burrows, in which they dwell, and are much sought after by the hunter, their flesh being held in great estimation.

Though heavy and corpulent, the pacas are very active, leap with address, and swim and dive with great facility. Their voice resembles the grunting of a young pig, and they root in the ground with their nose. They feed on fruits and vegetables, are nocturnal in their habits, and the planter often rues the visits made by these midnight foragers to his sugar canes.

Paca, or rather Alpaca, is also the name of a domesticated variety of LLAMA.

PACCHIAROTTI, GASPARO (1744-1821), is by every contemporary account to be held the greatest singer of the close of the eighteenth century. He was a descendant from the painter Pacchiarotto, and his family were styled in Italian fashion the Pacchiarotti (cf. the "Medici" and similar instances). The troubles spoken of in the article PACCHIAROTTO caused the family to remove from Siena, and Gasparo was born of a branch settled at Fabriano near Ancona. He had so lovely a voice and such an unusual talent for music as a boy, that he was made a victim to the cruel mutilation then freely practised to preserve the soprano voice for life, and soon rose to eminence on the operatic stage. The great singer De Amicis opposed his engagement for leading parts, and the patience with which he bore her insulting treatment till he fairly conquered her utmost admiration by his consummate skill, forms the matter for an oft-told chapter in operatic history. In 1778 he came to London, and at once captivated Burney and other critics, who have left us pages full of praise.

His voice reached easily to the C in alt,  and yet

was beautifully full in the lower register. His fancy was varied, and his emotional insight keen; he was well favoured in person, tall and slender, and a good actor. He made many friends in England, and endeavoured to cultivate our literature, keeping up a correspondence with English men of letters after his return to Italy. He came over for the Handel Commemoration of 1781, and again for the repetition at the Pantheon in 1791, the greatest musical festivals of the past century. Soon after the bust he retired from the stage, and lived at Padua. The Emperor Napoleon, then plain General Bonaparte of the French Republic, induced the artist to appear once before him in 1796 at Padua. This did not prevent the general from throwing him into prison for expressing sentiments of horror at the miseries caused by the war of the French invasion. Pacchiarotti was known and loved by all the artists of his time. Shortly before his death at Padua in 1821 Rossini spent some time with him—a curious link between the old opera with its male sopranos and the operas of our own times.

PACCHIAROTTO, JAC'OPPO. This Siennese painter, rendered interesting by being selected as the hero of one of Robert Browning's most extraordinary poems, concealing profound thought under the apparent guise of a rampant burlesque, is now proved to be beneath mediocrity as an artist. But formerly some very fine work, often credited to the great Perugino himself, was set down on good authority to Pacchiarotto. Further investigation proves that there was a Pacchia, the true author of these paintings, as well as the altogether inferior Pacchiarotto.

Girolamo del Pacchia was born in Siena in 1477, and disappeared from Siena after a tumult ending in the dispersion of a revolutionary club to which he belonged, in 1535. A "Virgin and Child" by Pacchia may be found in the National Gallery, but his best work is the celebrated "Nativity" fresco in San Bernardino, Siena.

Jacopo Pacchiarotto or Pacchiarotti, was born in Siena in 1474, and was a member of the same club of the Bardotti ("Spare-horses," i.e. horses not in the government team) as Pacchia. There is no wonder that two artists so very nearly alike in age, name, and temperament, and living in the same town, both being natives of it, should be confused; it would be extraordinary if they were not. More fortunate than Pacchia, Pacchiarotto escaped in 1535 by hiding beside a newly buried corpse in a tomb. When things had blown over he resumed work, but he was exiled in 1539. He was soon after permitted to return, but it was only to die. As regards Browning's weird poem, avowedly a defiance of his critics, who failed to see beyond the mere externalities of his work, it is probably the extreme to which a poet dare venture in extravagance. One distich is often quoted as a sample:—

"Henceforward, O mortal, paint not O,
Farewell to ye, cried Pacchiarotto."

PACE (Lat. *passus*), a measure of the Roman system, being their unit of itinerary measure, to which the *millæ passus*, *millæ passuum*, or mile was referred.

The pace was not, as persons in general suppose, the step, or the distance from heel to heel when the feet are at their utmost ordinary extension; this, which the French metrologists call *pas simple*, was the *gradus* or *gressus*. The *passus*, or *pas double* of the same writers, was two *gradus*, or the distance from the point which the heel leaves to that on which the same heel is next set down. Assuming the Roman foot at 11.62 English inches, the pace, which was 5 feet, must have been 58.1 inches, or 4.84 English feet, and the Roman mile, the *millæ passus* (or 1000 paces), equal to 1611 yards. In the British army the pace (half the Roman pace) is 2½ feet for ordinary marching, 3 feet for the "double quick."

PACHE'CO, FRANCESCO, a Spanish painter and writer on painting, is best known to us as the master and father-in-law of the immortal Velasquez. But he did good work of his own, though none of it is to be seen in England. There are several good specimens at Madrid and at Seville. He was very popular in his day, and set up an open studio. He was born at Seville in 1571 and died in 1654. The last twenty-five years of his life were devoted to art-literature, his work on the art of painting appearing in 1619.

PACHI'RA, a remarkable genus of tropical plants belonging to the tribe BOMBACEÆ and order MALVACEÆ. They are handsome trees, with brilliant and large flowers and digitate leaves. The three most noted species are *Pachira alba*, *Pachira Fendleri*, and *Pachira Barrigona*, all of which are valuable as affording a useful timber and a valuable fibrous bark. The wool of the seeds of Barrigona are used for stuffing cushions.

PACHOMIUS, an Egyptian monk whose name occupies so prominent a place in the early history of monasticism, inasmuch as he was the first to substitute for the free asceticism of the individual hermit the regular cenobitic system, was born about 292, and was originally a pagan soldier in the Roman army. He was converted to Christianity by the kindness of certain Christians with whom he came in contact near Thebes; and when his term of service had expired he spent twelve years with one of the devout recluses of the Thebaïs. He afterwards founded a society of monks at Tabennæ, an island of the Nile, the members of which were bound together by certain rules of life and conduct, strict obedience to himself being one of the chief. He also established the first convent for nuns, who were placed under the presidency of his sister, and the new institutions became so popular and successful that it is said there were about 7000 monks and nuns living under his rule at the time of his death in 348. There are a few writings extant which are ascribed to Pachomius, but their genuineness is doubtful. See also MONASTICISM.

PACHYDERMATA is an order of Mammalia established by Cuvier, now forming part of the order **UNGULATA**. The Pachydermata were divided by Cuvier into three families: the first, Proboscidea, contains the elephants, and now either forms a separate order or an appendix to the Ungulata; the second family included the non-ruminant artiodactyles and the perissodactyles, with the exception of the Equidae, which formed the third family. The remarkable genus *Hyrax*, which also fell within Cuvier's second family, now occupies an isolated position like the elephants.

PACIFIC OCEAN, THE, extends between America on the east, and Asia and Australia on the west. It received this name from Magellan, the first European who traversed it, because of its tranquillity when he entered it, after having been beaten about in doubling South America.

The Pacific is the greatest expanse of water on the globe. The area is roughly estimated at about 70,000,000 square miles, or about two-fifths of the whole surface of the earth. Behring Strait, which may be considered as its northern boundary, lies between East Cape in Asia and Cape Prince of Wales in America, near 66° N. lat., and is less than 40 miles wide. From this point southward, the coasts of both continents which inclose the Pacific recede rapidly from one another, and at 54° 30' N. lat., between the western point of the peninsula of Alaska and Cape Krotzkoi Noss in Kamtchatka, they are upwards of 1200 miles apart. Near the northern tropic, Cape San Lucas in California is about 8500 miles from the coast of China east of Canton; and this may be considered as nearly the average width of the Pacific between the tropics. Near the southern tropic, Sand Cape in Australia is about 8200 miles from the northern coast of Chili. Towards the southern extremity the Pacific is divided from the Atlantic by a line drawn from Cape Horn to the Antarctic Pole, and from the Indian Ocean by another line drawn from South-west Cape in Tasmania to the same pole.

The Pacific does not, like the Atlantic and Indian Oceans, send off branches which penetrate deeply into the adjacent continents; but extensive peninsulas project from the continents which border on it, and these, together with some adjacent rows of islands stretching far into the sea, separate considerable portions of it from the main body of the ocean. This is less the case on the American than on the Asiatic side.

Though the Pacific covers nearly one-half of the surface of the globe, it receives the drainage of a comparatively small portion of the land. In South America the watershed between the rivers which run into the Pacific and the Atlantic is only a few miles from the shores of the former towards the southern extremity of that continent; and thus the Pacific receives hardly more than one twenty-fifth part of the drainage of South America. The area of the countries of North America whose drainage runs to the Pacific probably does not exceed one-fifth of the whole surface. In Asia, the watershed between the rivers which fall into the Arctic Ocean on one side, and into the Pacific on the other, is likewise at no great distance from the latter; and it is supposed that only one-seventh of the drainage of Asia, and one-tenth of that of Australia, flows into the Pacific.

The eastern, northern, and southern portions are remarkably free from islands; three small groups of oceanic islands only occur towards the American coast, the Juan Fernandez group off Valparaiso, the Galapagos on the equator, and Revillagigedo on the parallel of 20° N. West of these there is a north and south zone, 40° of lon. in breadth, entirely free of islands, excepting the solitary speck of **EASTER ISLAND** (27° 10' S.) The great island zone of this ocean, its most remarkable feature, is contained between the parallels of 30° N. and 30° S., and stretches from its western boundary to lon. 130° W., where the Mar-

quesas, Low Archipelago, the Society, Austral, and Cook's groups stud its bosom with countless multitudes of small isles and mere rocky points. North-west of the Marquesas, through 30° of lat., is a wide open space, free of isles (except the line of islets forming the Fanning group), bounded north by the great Sandwich group, between the parallels of 20° and 30° N., and west in the meridian of 175° E., by the archipelago of Marshall's Isles, Gilbert's Isles, the Carolinas, and Ladrões, which conduct us to the Philippines, in North-west Oceania. It was through the first mentioned zone and this open space that Magellan, the first explorer of the Pacific, steering boldly out from the strait which bears his name, passed through the entire breadth of the ocean without once seeing land till he touched the Ladrões. North and north-west of the Sandwich group is open ocean till we reach the Aleutian, Kurile, and Japan Isles; but south of the equator, and eastward from Papua, Australia, and north-east of New Zealand, the surface is covered by closely set, irregular groups, which it is almost impossible to classify. They have been named the Salomon, New Hebrides, Viti, Friendly, and Navigator's Isles. Excluding the New Zealand group, the largest island of the Pacific, properly of the pelagic class, is New Caledonia; for all the others of considerable size, as New Britain, New Ireland, and a few others, are closely connected with the large masses of land which border the ocean, and this island is the only one whose geological formation presents features not common to the whole of the groups in the Pacific. Various rocks, such as are found on the continents, occur upon it; but with this exception, all the other Pacific groups are either of coralline or volcanic origin, or have been produced by the joint action of both agencies.

Much light was thrown on the physical conditions of the Pacific by the United States government in the *Tuscarora* expedition, 1873-76; by the British *Challenger* voyage, 1874-76; and by the German *Gazelle* expedition in 1875-76. With regard to the depth of its huge basin, a line drawn from New Zealand straight to Vancouver Island divides the great ocean into two remarkably contrasted regions. The vast area lying to eastward of this line, or between it and America, appears, as far as is yet known, to present no great inequalities of depth, but to have a tolerably level floor generally from 2000 to 2500 fathoms. This is the section of the ocean which is comparatively free from islands. The bed of the western or island-covered region, that which lies between the above dividing line and Asia, unlike the eastern, is characterized by great submarine plateaus and profound depths, rapidly varying. The most extensive of the deep regions of this part of the Pacific appears to be that which has received the name of the Tuscarora Deeps, which extends as a profound basin from the immediate coasts of Japan and the Kurile Islands, eastward along the south of the Aleutian chain. The greatest depth as yet measured in the Pacific, or certainly ascertained in any part of the ocean, lies within this region, about 150 miles south-east of the centre of the Kurile chain, where the sea-bed was found by the *Tuscarora* to be 4655 fathoms, or nearly 5½ miles below the surface. Between the Ladrone and Caroline Islands, the *Challenger* discovered another deep basin, which has been named from that vessel; here the bed lies at one point 4575 fathoms below the waves. Out in the central region, bordering on the line of division that we have referred to, lie other deep hollows of the sea-bed, sinking below 3000 fathoms, the largest of which are the Belknap Deeps between the Sandwich and the Fanning Islands, and the Miller Deeps between the Fanning and Phoenix groups. As in the Atlantic so in the Pacific the temperature of the depths of the sea is found to decrease to a minimum as the thermometer is lowered below the surface, or to remain stationary after decreasing to a certain point,

exactly in proportion to the freedom of access, in the basin in which the observation is taken, of the gradual flow of coldest water from the polar areas towards the equatorial zone along the inequalities of the bottom of the sea.

The Pacific has some remarkable currents; of these the most important is the Antarctic Drift Current, which, driven eastward in the belt between 40° and 60° S., before the prevailing westerly winds, impinges on the south American coast, and dividing off Chili, sends one branch round Cape Horn, through the South Atlantic, towards Australia; while the other, called the Chili or Humboldt's current, passes along the American coast, producing a striking effect in refrigerating those shores. It falls in with the general drift of the sea, beneath the steady south-east trade wind, off the north-west coast of south America, and crosses the ocean westward as the South Equatorial Current of the Pacific, occupying much of the space between the equator and the southern tropic. Arriving at the western side of the ocean, one part of this great drift current is deflected southward as the East Australian Current, and part passes through the many channels of the East India Islands into the Indian Ocean at certain seasons. The direction of the currents in the East Indian Archipelago is, however, in the main, dependent on the monsoon winds. A great North Equatorial Current, formed by the drift before the north-east trade wind, crosses the Pacific, from off the coast of North America, past the Sandwich group, to the shores of Japan. Between these two great drifts of the Pacific, the north and south equatorial currents, a counter equatorial current flows back towards America. Off the coasts of China and Japan, the North Equatorial Current forms and feeds the most remarkable and most definite of the currents of the Pacific. This is the *Kuro Sivo*, or Japan Current, which has its counterpart in the Gulf Stream of the Atlantic. It passes the shores of Japan in its north-eastern course, with an average flow of 50 miles a day; a branch from it flows northward along the Kurile Channel and the east coast of Kamchatka, and at some seasons makes its way even through Behring Strait, to clear away the ice from the arctic basin round the northern mouth of the strait. Its main volume, however, passes eastward between lat. 40° and 50° N. across the Northern Pacific to the shores of America with the westerly winds, bringing clouds and rain to the high shores of British Columbia, and thence bends round to rejoin the drift impelled by the trade wind.

The shores of the continents washed by the Pacific are in general high and rocky. Although the rainfall is practically constant all across the Atlantic and Pacific at very low latitudes, *i.e.* along and near the equator, where a zone of calm prevails between the trades, and where consequently an ascending movement of the air continually produces a canopy of dense cloud, as its moisture condenses on reaching higher and colder regions, yet in the Pacific, at about 150° W., and close to the equator, there lie islands, such as Malden Island, dotted over the space between 6° N. and 11° S., which are practically rainless regions. This remarkable exception to a rule often stated as absolute is proved not only by observation but by the rich and old deposits of guano, which of course a constant rain would soon wash away.

PACINI, GIOVANNI (1796-1867), an operatic composer and writer of works on musical composition of some importance and authority in their day, was born in Catania in Sicily. He studied chiefly in Venice, and while yet a youth made a great success in opera. During his long life he composed, besides enormous masses of church music, eighty operas: producing rapidly and writing slightly, and always rather with reference to the special artists who were to perform the works, than to the intrinsic beauty of the work itself. Consequently his operas have all died out, although his masterpiece "*Saffo*" was

only written in 1840, and his "*Niccolò de' Lapi*" was produced (posthumously) in 1873. About 1880 he was appointed musical director to the ex-empress of France, Maria Louisa (widow of Napoleon I.), and in 1854 he served the second Napoleonic dynasty by writing a cantata in Paris in honour of Napoleon III.

PACINIAN CORPUSCLES, named after the microscopist Pacini, who discovered them, are little elongated oval bodies attached by narrow pedicles to certain nerves of both the cerebro-spinal and sympathetic nerve-systems, especially the nerves of the skin of the hands and feet and the great abdominal plexus and mesentery. When numerous they give the terminal twigs of a nerve an appearance like a sparse bunch of currants. Their function is still obscure; possibly they are reservoirs of nerve force.

PACKFONG' or PETONG', or Chinese White Copper, an alloy formed by fusing together, in a covered crucible, arsenic, 2 parts, and copper clippings, $\frac{3}{4}$ to 5 parts, arranged in alternate layers, and covered with a capping of common salt. The alloy thus obtained is yellowish-white in colour when in the rough, but it takes a fine white polish, resembling silver. It is slightly ductile, and at a temperature below that of redness it suffers decomposition, with the extrication of fumes of arsenious acid. It was formerly much used for the scales of thermometers and other instruments, dial plates, candlesticks, &c., but it is now almost superseded in Europe by the alloy of copper, nickel, and zinc, known commercially as German silver. It is, however, still used extensively in China.

PACK HORSE, a horse employed to carry goods, either fastened in bundles on its back, or slung in panniers, one on each side. Formerly packhorses formed almost the only means available for the conveyance of goods in England, the roads being too bad to allow of the use of wheeled vehicles. A special breed of horses, short-legged, stoutly made, and capable of great endurance, was retained and cultivated for this purpose. In some of the mountainous parts of Europe, and in many partially civilized countries elsewhere, this mode of conveyance is still largely employed, though the mule, from its sure-footedness and greater endurance, is generally preferred to the horse. Pack-mules are largely employed in military operations, and they serve to carry provisions, ammunition, tents, wounded men, &c. For mountain warfare the British army includes among its guns one made in two pieces, so as to be conveniently carried by mules, the parts being screwed together when the gun is brought into use.

PACTOLUS (Gr. *Paktólos*), a small stream in Lydia, the modern name of which is Sarbat, very celebrated in classical works for its auriferous sands. It rises on the north side of Mount Tmolos (the present Kizil ja Musu Daghi), and flowed past Sardis into the river Hermos (the modern Ghiediz-Chai). Other Lydian streams bore gold, but the sands of Paktólos were by far the richest, and it was through improved methods of washing, as well as of mining in Mount Tmolos, that the colossal fortune of Croesus (Kroisos) was attained. It is fabled that the first gold money was made from the gold of the Paktólos. No gold can be obtained from this source now: the ancients thoroughly exhausted the deposit.

PADANG', the capital of the Dutch government of the west coast of Sumatra, situated about 240 miles N.W. of Benoeolen, on the banks of a small river of the same name—the government buildings, port, European and Chinese houses being on one side, the native town on the other. The town is situated in a district which is covered with rice fields, clove gardens, and cocoas palms, and the climate though hot is healthy. There are Protestant and Catholic churches and an hospital. An active trade in colonial produce and gold is carried on with Europe, the archipelago, and the interior of the island. The first settlement at Padang was made by the Dutch in 1660.

PADDLE, a wooden implement, consisting of two wide flat blades with a stout handle joining them, used for propelling boats or canoes. It is of very great antiquity, and while probably the precursor of the oar, now most generally used by civilized peoples, it is still used by most savage nations. The action of the paddle is the reverse of that of the oar, so that, unlike the rower, the paddler sits or stands looking forward, and if alone propels his canoe by dipping the paddle alternately on either side. Where there are two or more paddlers, as a rule each man confines his strokes to one side of the boat, and a paddle with only one blade is generally used. The fulcrum which the rowlock of the boat supplies to the oar is given to the paddle by one of the two hands grasping its shaft, the other hand providing the motive force. Though the paddle possesses less propulsive power than the oar it has its advantages. The user faces the bow of his boat, and is therefore able to see where he is going; it does its work close beside the boat, and it can easily be reversed in action or used as a rudder, &c., a gain of some importance in threading narrow, winding, or unknown streams. By the Eskimo the paddle with which they propel their narrow *kayaks*, serves also to right them when overturned by the surf.

Paddle-wheels are modifications of the single paddle, in which a number of paddle blades are fitted together radially as the spokes of a wheel, which is made to revolve so that they beat upon the water, and by its reaction propel the boat to which they are attached. They are not a modern invention, as the paddle-wheel was known to the ancient Egyptians, and wheel-boats, propelled by oxen, horses, and men were known to the Romans, and used as ferry boats in more modern times, but paddle-wheels were not effectively used until the introduction of steam as a motive power about the beginning of the present century. The first steamboats constructed were all fitted with paddle-wheels, arranged either at the stern or on either side, the screw propeller not being brought into practical use until thirty years later. The respective merits of the screw and paddle-wheel were for many years the subject of earnest discussion, but the question has now long been practically settled. For short sea runs and in smooth water paddles are the best, but for ships of war and the large vessels used for long voyages, the screw-propeller is universally used.

PADDLE-FISH (*Polyodon*) is a genus of fishes belonging to the order GANOIDEI, and nearly allied to the sturgeons (*Acipenser*). The paddle-fish is remarkable for having the snout produced into a very long shovel-like process. It differs from the sturgeon in having the body naked or only provided with small star-shaped ossifications. The mouth is wide, and both jaws are armed with minute teeth. There are no barbels. *Polyodon fulvum* is found in the Mississippi, attaining a length of about 6 feet, of which the snout takes one-fourth. A second species of paddle-fish, *Psephurus gladius*, inhabiting the Yang-tse-kiang, grows to an enormous length, specimens 20 feet long having been recorded. The shovel-like process is supposed to function as a sense organ to guide the fish to its prey, since the waters it inhabits are too turbid to allow it to make use of its eyes.

PADDLE-WOOD is the common name for the tree *Aspidosperma excelsum*. It is so called on account of the use to which the Indians of tropical America put the projecting portions of the wonderfully fluted trunk. In a portion of a trunk in the Natural History Museum at South Kensington, the central part is only about 8 inches in diameter, whereas the "boards" project all round from the centre to a distance of 7 inches. There are several other species of the genus, the timber of all being valuable; they belong to the order APOCYNACEÆ.

PADDY or **PADDIE**, the name by which rice in the husk is generally distinguished in India. It is the Tamil and the Malay name.

PADINA is a genus of ALGÆ. *Padina pavonia* is the peacock's tail or turkey-feather laver, so named from its beautiful fan-shaped frond. It is common in the tropics, but occurs even on our southern shores.

PADISHAH (Pers. *pād*, protector, and *shah*, prince), one of the titles of the Sultan of Turkey and of the Shah of Persia, and one that was assumed by Baber and his successors on the throne of Delhi. In the diplomatic language of the Divan this title was formerly accorded only to the King of France among Christian monarchs, but during the last century it was allowed to the emperors of Austria and Russia, and it has since been accorded to other powers.

PADUA (Ital. *Padova*), a fortified city of Northern Italy, in the province of Venice, is situated in a fertile plain on the river Bacchiglione. Padua is fortified with walls, ditches, and bastions, and is above 6 miles in circumference; but it is thinly inhabited, the population in 1882 having been only 72,174. Most of the streets, especially in the old part of the town, are narrow and lined with arcades; it has, however, some fine squares and handsome gates. Manufactures of silks, ribbons, and cloths are carried on. The principal buildings are—the unfinished cathedral, begun in the twelfth century, and having a fine baptistery; the episcopal palace; the churches of Sant' Antonio, Santa Giustina, Santa Croce, the church of the Eremitani, and many others, adorned with fine paintings and sculptures; the university, containing an anatomical theatre, a cabinet of natural history, a botanic garden, an observatory, and a library of 100,000 volumes; several colleges; the Palace del Capitano; the Palace Giustiniani; the Caffè Pedrocchi, one of the most splendid coffee and assembly rooms in Europe; and the palace of justice, a vast structure, of which the great hall measures 270 feet long, 90 wide, and 78 high.

The celebrated University of Padua, founded in the thirteenth century, had students from every part of Europe in former times, among them being Tasso and Columbus. The Prato del Valle, or public promenade, is adorned with numerous statues of distinguished Italians.

Patavium (Padua) was considered in Roman times one of the oldest towns of Italy. At the fall of the Roman Empire it was destroyed by Attila, and the inhabitants removed to the islands in the lagoons, where they founded Venice. Patavium was rebuilt by Narses, ravaged by the Longobards, and restored by Charlemagne. It afterwards governed itself for a long time as a free municipality with its consuls and podestats. In the thirteenth century Ezzelino da Romano usurped the sovereign power, but after his death the Paduans not only regained their freedom, but extended their authority over several adjacent provinces. Soon after the Carrara became lords of Padua until 1406, when Venice took it by force and united it to its territory. The historian Livy was a native of Padua.

PÆAN (Gr. *paian*, *paion*; Ionic *paion*), a hymn of hope and courage, which was originally sung in honour of Apollo, who was also called Pæan. It was sung at all the solemn festivals of the god, at the cessation of a plague, and after a victory. It was also sung by the Greek troops previous to an engagement.

PÆDO-BAPTISTS (those who baptize children), a term used by modern theological writers to distinguish those, of whatever sect, who practise infant baptism, from the body who are called BAPTISTS.

PÆONIN, a red colouring matter obtained by the action of sulphuric and oxalic acids on phenyl alcohol. It forms a splendid reddish-purple colour when dissolved in ammonia, and it is deposited therefrom as an orange-red powder. The formula is $C_{10}H_6O$.

PÆONY (*Pæonia*) is a genus chiefly of European and Asiatic plants, belonging to the order RANUNCULACEÆ, and very generally cultivated in gardens for the sake of

their large and richly-coloured flowers. One species (*Pæonia Montanum*, or tree peony), a native of China, is a shrub, of which several varieties, with beautiful whitish flowers stained with pink, are now in our gardens. Of these the most showy is that called *Pæonia papaveracea*, which has a broad crimson stain at the base of each petal. The disc in the montanum is enlarged into a kind of cup which envelops the five carpels. It differs also in its shrubby habit.

All these plants are liable to produce double flowers which, by the conversion of their numerous stamens into petals, are generally extremely beautiful; they have, however, no smell, or not an agreeable one. Being quite hardy, growing readily in any kind of soil, and easily multiplied, they are generally favourites in gardens.

PAER, FERDINANDO, was born at Parma in 1771, and received his first instruction in music at the Conservatorio della Pietà, in his native city, and began his career as a composer of operas at Venice, where he became musical director in 1791. In 1797 he accepted an invitation to Vienna, where he produced three or four operas, and some cantatas for the Empress Theresa. In 1801 he succeeded Naumann at Dresden, and there brought out his "Eleonora" (on the same subject as the "Leonora" or "Fidelio" of Beethoven) and "I Fuorusciti." In 1806 he was taken into the service of the Emperor Napoleon, and appointed composer and conductor of the chamber music of the Empress Marie-Louise. The court favour he enjoyed was not discontinued on the restoration of the Bourbons, and he retained the direction of the Opéra Italien (when he had succeeded Spontini in 1812) till the year 1827. In 1831 he was created a member of the Académie, and the next year director of the king's music to Louis Philippe. Paer died in 1839, regretted by few. His greedy intrigues for place and power were detestable in so good an artist. His musical fate was unlucky. His genius was considerable, but essentially Italian, and Rossini barred the way with his absolute possession of the stage. Paer's work is quite overshadowed in consequence, and rather unjustly so.

PÆSTUM (POSEIDONIA), an ancient town of Lucania, about 4 miles south-east of the mouth of the Silarus, near the coast of the Gulf of Pæstum, now the Gulf of Salerno. The surrounding country, which is low and marshy, lies between the sea and an offset of Mount Alburnus, which divides it from the valley of the Calore, an affluent of the Silarus. The sulphurous springs which are in the neighbourhood form stagnant pools, and a stream which flows past the walls of Pæstum, by occasionally overflowing the low grounds, adds to the unwholesomeness of the atmosphere. The whole lowland is deserted, and the only villages are on the hills, and yet in the ancient republican times the whole country was a garden. The "roses of Pæstum" were proverbial for their beauty and luxuriant growth, though now there are only weeds to be seen. Gradually, however, the land between Pæstum and Salerno (or rather Battipaglia) is being reclaimed by ox-ploughing and cattle-feeding, and the railway under construction will assist these recuperative efforts. Even in Augustine's time Pæstum had acquired an ill name for occasional malaria.

The remains of Pæstum are about 25 miles S.E.E. of the town of Salerno; they consist of fragments of the town walls, 3 miles in extent, two fine Doric temples, another Doric building, and a small Amphitheatre and temple of Roman origin, with fragments of an aqueduct also. Pæstum was at some early time (about 600 B.C. probably) occupied by a Greek colony, which gave it the name of Poseidonia, or the city of Poseidon. The devices on the medals of Poseidonia, anchors, oars, rudders, show that the people were a seafaring people. The Romans practically re-founded Pæstum, sending a strong colony to secure their conquest, B.C. 273, after the end of the war

against Pyrrhus. Nevertheless Pæstum faithfully assisted the Romans in their contest against Hannibal. During the middle ages the magnificent remains of Pæstum were little known except to the few who visited them, or to those who saw from the sea those splendid specimens of ancient architecture. In 1767 appeared at London the first description of Pæstum, "The Ruins of Pæstum" (folio, with four plates, anonymous); which was followed by Major's work, which had the same title, in 1768. There are other subsequent works on the ruins of Pæstum. The "Magna Græcia" of Wilkins also contains descriptions and architectural drawings of the temples. These are in the Doric style, and are the finest extant after those of Athens. They have indeed one immense superiority over even the matchless Parthenon, for the temple of Poseidôn at all events is a century older. The spectator, as he looks with admiration on the beautiful architecture of the ruin, and admires the exquisite faint orange colour of the glowing travertine stone of which it is built, finds it hard to believe that he has before him a monument twenty-four centuries old. The temples of Pæstum agree in their general character with other Greek temples, consisting of a cella surrounded by external colonnades. Both the main temples are of this description, being peripteral and hexastyle. The large temple, called that of Poseidôn (Neptune), is 196 feet long and 79 wide, with six columns at each end and twelve along the sides. The cella forms an inner court raised 5 feet, with a range of eight Doric columns on each side supporting an architrave, on which stands a second range of smaller columns of the same order. The external columns are very massive, being 7 feet in diameter at the base and 29 feet high. The upper diameter below the capital is only 4 feet 9 inches, from which it appears that the shafts decrease very suddenly. (See the chief parts of a column from Pæstum engraved in Plate II., GREEK ARCHITECTURE.) The smaller temple, called the temple of Ceres (Déméter), is 108 feet long by 48 wide; and it differs in several respects from the other and larger temple. The third building, the "Basilica," absurdly so called, was also probably a temple; it has nine columns at each end, and eighteen on the sides, those at the angles being reckoned again. It was divided in its breadth by an internal range of columns in the middle, some of which remain. These two temples are neither so ancient nor so noble as the grand fane of Poseidôn. Up to the time of our Norman Conquest Pæstum was a mine of wealth in Greek bas-reliefs, sculptures, and antiquities. At that time the barbarous Norman chief, Robert Guiscard, in his conquest of the south of Italy, when he founded the Norman rule over the "two Sicilies," plundered the glorious ruins of everything which could be broken or torn away.

PAGANINI, NICOLÒ, the prince of violinists, was born at Genoa in 1784. His father, a tradesman, initiated him in music, and succeeded so well that at eight years of age he played the violin in the church, as well as in public saloons, and composed sonatas. After studying under G. Costa, Rolla, Ghiretti, and Paer, he took an engagement at Lucca (1805), where he was appointed director of orchestra to the court. After travelling all over Italy and winning golden opinions everywhere, he visited Vienna in 1828. Here he was accused of having murdered his wife, but he refuted the charge. The year 1831 found him in Paris, in which capital he produced an immense sensation. He arrived in England in the same year, and met with great success; but somewhat endangered his popularity by the enormous prices which he attempted to extort. Paganini died at Nice in 1840, of a diseased larynx, leaving an immense fortune (£80,000) to his son.

His mastery over the violin was marvellous, though he too often used his power to captivate the mob of pretended amateurs by feats little better than sleight-of-hand, clever and unapproachable as they were. Thus he would usually

use strings so thin as to injure the musical tone of the fine instrument he played upon (a Joseph Guarnerius, presented by him to the town of Genoa, where it still is), but permitting the most marvellous feats of execution. He never practised nor even tuned his violin in public, nor did he write out the solo parts of his concertos, &c., for the reason that he used curious methods of fingering and tuning, whereby passages quite impossible with the ordinary instrument became possible. Many people seriously believed him in league with the devil, and he once published a letter from his mother to prove that he had not a diabolic pater-nity! Paganini was almost as accomplished on the guitar as on the violin. He devoted some years to the guitar to please a noble lady who protected him from 1801 to 1804. In his youth he was a great gambler, and long spells at the tables alternated with long hours of practice. His health was quite ruined by this immoderate life. He lost a large sum (over £2000) not very long before his death, by investing it in a gambling-club founded in Paris on an aristocratic basis. His generosity to Berlioz [see BERLIOZ] was probably almost the only noble thing he did with his vast earnings.

PAGANS, a term derived from the Latin *paganus*, a name given by the early Romans to rustics and villagers, but which was applied by Tertullian, and after him by other patristic writers, to those who refused to accept Christianity. The new religion was adopted by the educated and civilized inhabitants of the towns long before it reached the more simple-minded adherents of the old systems in the country districts, and after Constantine had prohibited the worship of the old gods and closed their temples, their sacred rites were still observed openly or secretly in remote country districts. The term heathens, which originally implied merely "the dwellers on the heaths," came in a similar way to be used to designate all who were not Christians, inasmuch as it was these rude uncultivated people who adhered most firmly to their old superstitions.

PAGE (*Lat. pagus*), a person attached to the service of a king, prince, or some illustrious dignitary. In the chivalric period this designation was applied to the young noble who was training for the duties and responsibilities of knighthood—first the page, then the squire, and lastly the knight. In the British royal household a certain number of attendants, selected from gentle and noble families, are called pages—as state pages, pages of the presence, and pages of the backstairs. The four pages of honour are personal attendants on the sovereign.

PAGET, HENRY WILLIAM. See ANGLESEA, MARQUIS OF.

PAGING MACHINES are ingenious contrivances for printing consecutive numbers with regularity and despatch, and are extensively used in numbering the pages of ledgers, account-books, bank-notes, tickets, &c. The great object of these machines is to prevent the chance of error or fraud by making it impossible that a page, cheque, note, &c., can be abstracted or lost without detection. The machine consists of a train of wheels with raised numbers on their edges and an inking apparatus. When the handle or lever of the machine is pressed down, one of these numbers comes in contact with the ink, and then with the paper. On raising the handle the wheels move to the next number, which immediately comes in contact with the inking apparatus, and gives an impression to the paper. It is impossible to miss one, or to produce a duplicate number until the whole series has been printed. Some of the machines will serve from one to a million and upwards.

PAGO'DA (a corruption of the Sanskrit *Bhagarati*, holy house), is a name generally applied by Europeans to temples in the East, from China to Hindustan. These structures generally consist of three subdivisions: (1) an apartment whose ceiling is a dome, resting on columns of

stone or marble—this part is open to all persons; (2) an apartment forbidden to all but Brahmans; (3) and last, the cell of the deity or idol, inclosed with a massive gate. The idol itself is sometimes styled a pagoda. The most remarkable pagodas are those of Benares, Siam, Pegu, and particularly that of Juggernaut in Orissa. Some of the Chinese pagodas are elevated upon a terrace, and consist of two storeys, the lowermost surrounded by a peristyle of columns. Others are lofty towers in several storeys, diminishing in height and width as they ascend. The name given by the Chinese themselves to such a tower is *Tiao*. The Hindu pagodas are of a pyramidal form.

PAGUS is the word used by Tacitus in his invaluable description of ancient Germany ("Germania"), to express the *hundred* of our forefathers—the union, that is, of a number of communities or townships for purposes of justice and common defence. See HUNDRED.

PAIN is an uneasy sensation in animal bodies which may arise from a great many conditions, and which is one of the most common symptoms of disease. It always resides in the nerves, whatever may be the cause which gives rise to the sensation. Different kinds of disease are accompanied by different kinds of pain, and the same disease may cause certain modifications of pain according to the part of the body affected. At the same time, the connection between pain and disease is not invariable, for some disease processes of considerable severity and importance are absolutely painless. Differing as it does in kind, degree, and mode of recurrence, its aid in diagnosis is frequently of higher value than any other single symptom, and though the sensation experienced may be only partially definable, the sufferer is often able to indicate its nature by comparing it with other sensations remembered or imagined. Thus people speak of throbbing, shooting, stinging, gnawing, aching, and tearing pain, and refer to it as being keen and sharp, or dull and heavy, while its intensity may be indicated by the use of such terms as slight, moderate, severe, violent, intense, excruciating, and agonizing. Sometimes these terms are used by sufferers without much regard to their accuracy, the tendency being generally towards exaggeration, but it must be remembered that different people possess different degrees of sensibility and feel with different degrees of acuteness. A pain which one person may endure without serious disturbance may cause prostration in another of weaker or more sensitive temperament, and this difference extends to races and nations as well as to individuals.

It is not always that the pain is felt in the spot where the exciting cause exists, many forms of disease being characterized by what is termed indirect or sympathetic pain. Thus pain in the right shoulder may be caused by inflammation of the liver or diaphragm, inflammation of the hip-joint excites pain in the knee, stone in the bladder causes pain at the end of the urinary passage, some forms of heart disease are attended by pain running down the left arm, and irritation of the stomach is one of the commonest causes of headache.

Pathologically, pain is of importance, inasmuch as it causes distress and exhaustion of nervous energy, interferes with sleep, appetite, and digestion, and when long continued it may bring about changes shortening existence, or may be so severe as of itself to occasion death. In most cases the treatment of pain is so involved in the removal of its exciting cause that no general rules can be laid down. Happily the means of relieving pain at the command of medicine are neither few nor slight, and even in cases where the disease itself is incurable, much may often be done to assuage the pain it causes. It is impossible to estimate the amount of human suffering that has been removed by the discoveries of ether, chloroform, and nitrous oxide, while in opium and its active principle morphia, in belladonna and Indian hemp, we have drugs which have

power over pain in its most agonizing forms. Rest is, as a rule, the first essential in the treatment of pain, and local applications in the form of simple poultices, mustard poultices, fomentations, counter-irritant or anodyne liniments, constitute the most ready means of relieving pain in many cases. In other cases the external application of cold may be called for, and a cool wet compress or ice bag will relieve pain as well as keep down inflammation. For small operations in surgery, cold may also be employed as a means of producing local anaesthesia.

PAINE, THOMAS, a celebrated agitator, political writer, and assailant of revealed religion, was born at Thetford in Norfolk, 29th January, 1737. His father was a Quaker, and his mother a member of the Church of England. He was brought up to his father's trade of staymaker, but until his thirty-seventh year passed a changeable life as privateersman, storkeeper, tobaccoist, schoolmaster, exciseman, and pamphleteer. He married twice, losing his first wife by death in 1761, and separating by arrangement from his second wife in 1774. He had gained some little reputation by this time as a politician of extreme views and a ready debater, and in 1774 he emigrated to America bearing a letter of introduction from Franklin to the leaders of the resistance to the mother country. He obtained immediate employment as a contributor to the *Pennsylvanian Magazine*, and in January, 1776, he issued his famous pamphlet entitled "Common Sense," in which he advocated with much ability the policy of separation from Great Britain and the establishment of a republic. At this period public opinion was greatly excited at the prospect of a struggle with the home government, and this pamphlet had an enormous sale and exerted an immense influence in the revolutionary direction. After the declaration of war Paine served as a private soldier, and in December, 1776, he issued the first of his tracts on "The Crisis," a series of earnest political appeals designed to rouse and sustain the public spirit of the colonists. Of these, sixteen were issued between December, 1776, and December, 1783, but the first, written two days before the battle of Trenton, and opening with the words "These are times to try men's souls," is the most celebrated. The opening phrase became a battle-cry for the soldiers of the revolution, and the series of tracts had a wonderful effect in restoring the courage of the people. For his services Paine was appointed clerk to the committee of foreign affairs from 1777 to 1779, and at the close of the war received 3000 dollars and an estate near New Rochelle, besides some small grants from Pennsylvania and New York. In 1787 he visited France, and in 1791 published in England the first part of his "Rights of Man," in reply to Burke's "Reflections on the Revolution in France." This had an immense sale, and the second part was issued early in 1792, but by this time the government had taken alarm and Paine was prosecuted for sedition. He did not await his trial but removed to France, where he was well received and elected a member of the National Convention. In the Convention he sided with the moderates, and during the trial of the king he voted in favour of banishment, and offered the monarch an asylum in America. After the fall of the Girondists he was excluded from the Convention as a foreigner, and in 1794 was arrested by order of the Robespierre party and committed as a prisoner to the Luxembourg. Here he remained a prisoner for ten months, escaping the guillotine by an accident, and during this period the first part of his "Age of Reason" was published at Paris under the auspices of his friend Joel Barlow, the second part being issued at Paris by the author after he had been set at liberty by the fall of Robespierre. The coarse ridicule directed against Christianity contained in this book gave great offence both in England and in America, and it estranged from Paine many who had formerly been his friends. Returning to America in 1802 he lived at his

farm near New Rochelle till his death. He died at New York, 8th June, 1809, his body being buried in his own grounds. In 1819 his remains were disinterred by William Cobbett, who brought them to England for the purpose of paying to them special honour.

From his first starting in public life Paine was a sincere, consistent, and earnest republican. As a writer his style was vigorous and clear, though at times somewhat coarse, and he possessed considerable power as a controversialist. His life has been written by Chalmers, Cobbett, Cheatham, Rickman, Sherwin, and Vale, and a complete edition of his works was published at Boston in 1856. His "Rights of Man" and "Age of Reason" are still reprinted by the secularists of England and America, and a complete collection of his political writings, in one volume, was issued in London in 1876.

PAINTERS' COLOURS. See **PIGMENTS**.

PAINTERS' CREAM, a composition made of six parts of fine nut oil, one part of gum-mastic, and some acetate or sugar of lead, and used by artists to cover oil paintings when they leave off work, in order to prevent their drying during the interval, and so showing a line or junction mark between the old work and the new. It is laid on with a soft brush, and can easily be removed with water and a sponge.

PAINTING. Pliny, the greatest authority upon ancient art, considers the origin of painting to be involved in uncertainty—*De pictura initium incertum*. But we may conclude that it dates back to a very early period in the history of the human race, as the self-love and the love of imitation combined, so natural to man, would soon prompt him to attempt a representation of his visage reflected in the water, or his shadow projected on the ground; and although we are ignorant of the precise date of the commencement of the art of painting, the tombs of Egypt and other ancient monuments inform us that it was known and practised, in the curious fixed formal and artificial ways which governed the whole of Egyptian art, and which made progress nothing less than impiety, more than 2000 years before the Christian era, or twelve centuries before the time when the Greeks claim its rediscovery by the love-sick Kora, daughter of Dibutades, a potter of Sicyon (Gr. *Sikyon*), near Corinth, who traced on the wall the shadow of the face of her departing lover, about to set out on a long voyage. Kleantes and Ardikos of Corinth, Philokles the Egyptian, and Telephanes of Sicyon, added various improvements to the simple outlines of Kora. But their portraits were still so rude and imperfect, that they were obliged to write under them the names of the persons whom they were intended to represent. Klephanes of Corinth was the first who added colour to design; but he used only a single colour, as did his followers and imitators. Eurares of Athens gave additional finish and precision to his portraits, and clearly marked in the faces the distinction of the sexes. Kimon of Kleonai (the headquarters of the art still keeping close to Corinth) seems to have first had some glimmering idea of perspective. He also varied the attitudes, rendered the articulation of the limbs, indicated the markings of the veins, and delineated the folds of drapery. Afterwards appeared the great name of Polignotos of Thasos (about 460 B.C.), who was conspicuous for the varied attitudes, graceful dress, and expressive countenances of his female figures. If it was who first ventured gently to open their mouths and show pearly teeth smiling behind rosy lips. Pausanias, Aristotle, Pliny, and Lucian, all celebrate the praises of this accomplished artist, who painted the Poikile at Athens—where his works appeared beside the "Battle of Marathon" by Paraios, the nephew of Phidias, himself also a painter, and the "Combat of the Athenians and Amazons" by Nirkon—and also the public hall at Delphi, with scenes from the wanderings of the Greeks after the fall of Troy. He may be said to have

established the essential principles of art. Form, expression, and, to a considerable extent, colour, seem, by what we read in the ancients, to have been thoroughly understood by Polignôtos and his contemporaries. The great artists of the Alexandrian period who succeeded them, added more perfect imitation, more harmonious colour, more dramatic fidelity of composition. They refined the art and carried it to a higher degree of technical excellence. But the essentials of painting had been already comprehended and put in practice. Greek art had arrived at almost the same relative stage which Italian art reached about 1900 years afterwards, when Masaccio received it from the hands of Cimabue and Giotto, and gave it an onward impulse which lasted even to the time of Raffaele. Polignôtos was the precursor of Zeuxis, Apellès, and Protogénès, as Masaccio was of Lionardo da Vinci, Michelangelo, and Raffaele.

The Greek republics grew in freedom, power, wealth, and civilization. Among them the greatest and most highly honoured citizen was not the richest, but he who displayed the most distinguished personal worth and the highest ability. All were invited to a competition, where what was truly excellent in nature, in conduct, in art; whatever was great, graceful, and becoming; whatever could develop and complete the human character—was the object of general admiration. About a generation after Polignôtos, or about 430 B.C., appeared Apollodôros the Athenian, who is said to have been a master of expression and colour. Contemporary with him, though a younger artist, was Zeuxis, celebrated for the force and grandeur of his design and for the lofty character of the subjects which he selected. For his famous picture of "Helen" he chose five of the most beautiful maidens that could be found, in order that by a union of their various perfections he might produce a single figure more lovely than any one of them. His greatest work was a picture of Zeus sitting on his throne surrounded by the other deities. Timanthès, Eupompos, Androkidès, and Parrhasios of Ephesus, all flourished during the same era as Zeuxis; but the last-named is the only one who is worthy of being considered his rival. The story of their competition, as related by Pliny, is well known. Zeuxis painted a bunch of grapes so natural in appearance, so juicy-like, and so inviting, that the birds came to peck at them. He then asked Parrhasios in his turn to raise the curtain covering his performance. But the supposed curtain was the painting itself. Zeuxis declared himself vanquished, exclaiming, "Zeuxis has deceived birds, but Parrhasios has deceived Zeuxis himself." We now come to the great masters of the Alexandrian period, such as Apellès, Protogénès, Aristeidès, Pamphilos, Euphranôr, Pansias, Nikias, Nikomachos, who, in different degrees and manners, excelled in beauty, grace, expression, and finish, and carried ancient art to its highest degree of technical perfection. The greatest of these was Apellès, the prince of ancient painters. He was the favourite artist of Alexander the Great, who made a law authorizing Apellès alone to paint his picture, and who even presented him with his mistress Kampaspe, with whom the painter had fallen in love while taking her portrait.

After the close of the Alexandrian era painting, along with freedom, began rapidly to decline, and the great period of Greek art comprehends little more than 200 years, or from the time of Periklès to the end of the age of Alexander the Great. It is worthy of observation that the most flourishing era of modern art is also comprehended within a similar period, or from the time of Masaccio, in the earlier part of the fifteenth century, to the days of the immediate followers of the Caracci, in the first half of the seventeenth. Another remarkable resemblance between these two periods of ancient and modern painting is likewise deserving of notice—namely, that in both it was soon after the art had reached its highest point of technical

excellence, when finish was most delicate and imitation most accurate, that it began to decline. The essence was sacrificed to the form, and imitation was made the end instead of the means of art. The school of the Caracci, high as was its aim, was, when compared with the Roman and Florentine schools at the commencement of the sixteenth century, just such a transition from *essence* to *form*, from *sensibility* to *sense*, as that which took place in Grecian art immediately after the period of Alexander. Our information of the processes by which the ancient painters arrived at the results which astonished and delighted their contemporaries is comparatively meagre and indistinct. But we are entitled to infer, from what has come down to us in the sister art of sculpture, that the phrases of unlimited praise bestowed by the ancients upon Greek painting were as well deserved as we know their similar praises of Greek sculpture to have been, since of the latter we have ocular demonstration. Of the technical methods of the Greek painters we know unhappily nothing, or next to nothing, beyond general outlines. There were two chief methods followed—painting in water colours or tempera, and painting in wax. Besides these we have fresco, vase-painting, and mosaics; examples of the three latter fortunately still remain, though none of great antiquity or of the most supreme excellence. The pigments for the fresco seem to have been simply ground in water, those for easel pictures (tempera) being mingled with white of egg, gum, &c. But the favourite method was the encaustic wax-painting (Gr. *enkautika*, burnt in), used at and after the Alexandrian period. The colours were mixed with wax, and "waxes" (Lat. *ceræ*) were sold at the shops as paints are now. When the colour had been spread on the picture, an application of heat was made in such a way that the tints were harmoniously fused, and also the whole picture became firmly united with its linen ground. Not one specimen of this work remains. Of the later fresco numerous examples of a coarse kind, and some few of great beauty, are happily preserved to us through the long burial of Pompeii. Many of these are hurried stencillings on walls to serve the office we now fill by wall papers, and were executed by Greek workmen for the aristocratic Roman society of that fashionable watering place. We know also that a large use of painting was made in architecture and in the ornamentation of statues by both Greeks and Romans.

The political revolutions which distracted and convulsed Greece after the death of Alexander, and its subsequent degradation into a Roman province, were highly unfavourable to the cultivation of painting; and among the Romans architecture was the only one of the fine arts which was successfully cultivated. The Romans, in fact, plundered their art as they did their money. Heaps of pictures arrived from Greece during the successive conquests. Soldiers were seen playing dice on the most priceless canvases, and one very beautiful work was destroyed at Rome by the guardians of the temple to which it was dedicated, who washed it completely away, thinking to clean it! There were, indeed, numbers of Greek painters employed in Rome in the time of the empire; but they were merely genre painters, limners of portraits, decorators, caricaturists, and even panders to the depraved sensuality that pervaded the higher ranks of Roman society. Julius Cæsar, Agrippa, and Augustus had been splendid patrons of art, but the later Romans let it fall into neglect.

The fall of the ancient religion and the rise of Christianity brought with them a marked difference in art. Gradually what is called the Byzantine school was evolved, a phase of art which we have preserved for us in many frescos and more mosaics, of immense value to archaeologists and historians of art, however little pleasing they may be to the lover of beauty. The earliest Christians so hated the errors of paganism that its very beauties were abhorrent to them. The fine frescos and sculptures of the Greeks were

to them so much unlawful praise of the flesh which corrupts. They plunged into mystic symbols, as the cross, the dove, the fish, the palm, &c. Even Christ himself was symbolized as a shepherd. If a saint or a martyr had to be represented, as much care was taken to show as little of the bodily form as the rules of a nunnery would exact. The head, hands, and feet alone appeared beyond the stiff and angular drapery whose folds were carved or painted in straight, rigid, unlovely lines. It was comparable (though to a far greater extent) to the blotting out of all joyous art which our own country underwent at the hands of the seventeenth-century Puritans. That this reaction against sensual delights, however pure, is only a part of human nature, and that it is the necessary accompaniment of great and noble zeal which we cannot too sincerely admire, need not in the least blind us to the fatal ruin wrought by it upon all that makes life lovely and pleasant.

The Byzantine manner grew at last as conventional as the Egyptian, indeed in some respects it was even less free. It is very difficult to be sure of portraits or of any representations of natural objects preserved from that age, for everything is symbolized and purposely denaturalized. Yet this purely decorative art, with its crowds of saints, painted on a gold ground, all standing in a precisely straight line and all coloured in crude and unblended tints, has a certain majestic barbaric splendour of its own. Later ages have known how to utilize the splendid effects, while harmonizing the tones and bringing beauty into the arrangement of forms and grouping, as witness the splendid mosaics which now decorate the dome of St. Paul's Cathedral. The culmination of the Byzantine art is in the sixth century, and it continued to rule the civilized world until the thirteenth.

Rise of Italian Art.—In the chaos of unhappy Italy after the fall of the empire art of every kind was practically non-existent; but the Crusades, and especially the Latin conquest of Constantinople in 1204, once more brought the Romans and the Greeks into contact. The formal but well-trained Greek Byzantine painters and sculptors came to Italy, and the Italians woke with a start from the sleep of centuries. A very few years sufficed for them to burst the swaddling-clothes in which Byzantium had crumpled the art of painting, and to found an entirely new and loftier ideal.

Giovanni Cimabue, born at Florence in 1240, is generally regarded as the father of modern painting. He probably studied under Greek masters, but his genius soon led him to emancipate himself from the conventional fetters which compelled Byzantine art to remain unfruitful and unprogressive. His greatest work was the "Madonna and Infant Christ," painted about 1270 for the Church of Santa Maria Novella. So impressed were the Florentines with the merits of this picture that they carried it in procession, with trumpets sounding and banners displayed, and in the midst of a vast concourse of spectators, from the house of the artist to the church it was destined to adorn. Cimabue also executed some important frescoes for the Church of St. Francis at Assisi. What still remains to us of his compositions shows a great improvement upon the stiffness of the Byzantine school. His heads and figures occasionally attain an air of grandeur and dignity; but at the same time an accurate imitation of nature, and the power of rendering characteristic and graceful action, are still deficient. He died in 1312. Duccio di Buoninsegna (about 1260-1320) did all (perhaps more) for Siena that Cimabue did for Florence. His greatest work is the altar-piece in the cathedral at Siena; and he, as well as Cimabue, is represented in our own collection.

Fresco.—It is most instructive to compare the work of these men with that of their predecessors, and note that, archaic and stiff as they are to us, they represented nothing less than a revolution in their own day, a revolution still startling as we gaze upon its traces. It

remains to give some reasonable explanation of this sudden reawakening of art, and especially of the art of fresco painting in Italy. It is certainly to be found in the material prosperity now at last beginning to revive in the country. Without material prosperity it is impossible to provide men who can be supported in leisure to work at beautiful as contrasted with useful things. In the twelfth century Italy gained this new start of prosperity. There remains the question why it should be painting, and especially fresco painting, which was the chosen means of expressing beauty. The answer lies in the fact that the first use men make of art is to decorate what is most precious to them. Now a great religious revival marked the thirteenth century in Italy. The Franciscans and Dominicans vied with each other in their efforts to touch the common people. Thus decorative art would be imperatively called forth by the religious enthusiasm of the period, which so believed in and loved its faith that it sought to show that belief and love by lavish gifts towards the decoration of its homes. The Franciscans, who, of the two great contemporary bodies of friars, were the first really to catch and fix the enthusiasm of the people, since they preached more to the heart than did the Dominicans, were simple and poor, and preached to the simple and poor. They needed great churches, unencumbered with pillars, &c., so that all could see and hear the fervent preacher—plain halls, roomy and cheap. Huge brick churches, which at this day look like substructures for churches ("like skinned animals," as George Eliot said), are found still all over Italy. These were plastered over inside, and it was the tempting surfaces of wide-stretching plaster, unbroken by arcade or carved stonework, that invited decoration so soon as the richer folk began to turn to the preaching of the friars. Artists who were devout lent themselves eagerly to the work, and the bare walls became splendid.

Moreover, as the Franciscans, aiming at touching the heart, found that their end was best accomplished by tales of noble men, rousing weaker souls to emulation, the swift methods of fresco afforded means of covering their churches with representations of the very tales with which the pulpits were ringing. The preacher who, for instance, commended St. Francis' stripping himself of his clothes for the poor, could point to roof or wall where the blessed one was in the act of borrowing his friend the good bishop's mantle to cover his nakedness.

Siena.—Painting now divided into two schools—those of Florence and Siena. Florence, with Cimabue at its head, as became a Guelph democratic merchant-city, worshipped force, keen vigorous observation, and dramatic effect; Siena, from the very first, led by Duccio, revelled, as became a Ghibelline aristocratic stronghold, a community of splendid knights, in sentimental ideal aspects, in delicate embroideries of gold and lace work, in fine costume and grace of every sort. The difference is carried on steadily for generations of artists, till Orcagna finally blends the two streams. As regards the town of Siena itself, its artistic splendours were cut short, probably to the great loss of the world, by a terrible pestilence in 1348, in which 80,000 died. This awful blow ruined her, and even the cathedral works had to be stopped, never more to be continued. Duccio was succeeded as leader by Simone Martini (1283-1344), whose fine frescoes are still to be seen at Siena, by Menuni, and by the two brothers Lorenzetti.

Florence.—Turning back now to the school of Florence we find that to Cimabue succeeded his pupil Giotto (1266-1337), who effected a mighty revolution in art, and the force of whose example extended far beyond his own times. His influence was not confined to Florence or Tuscany. The whole of Italy, from Padua and Verona to Gaeta and Naples, is indebted to him for various works and for a new impulse in art. Popes and princes, cities and monasteries, vied in giving him commissions, and were proud of possess-

ing his works. Giotto, like many of the great mediæval artists, was sculptor and architect as well as painter. The beautiful Campanile adjoining the cathedral at Florence was designed by him, and several of the statues which adorn it were wrought by his hand. He introduced natural incidents into his pictures, gave dramatic interest to his groups, and improved and enriched the meagre composition of his predecessors. Rather more than a century elapsed between the death of Giotto and the commencement of the artist-life of Leonardo da Vinci, and during that century painting advanced with rapid strides. The early Italian painters wrought chiefly in tempera—that is to say, with colour mixed with white of egg into which the twigs of green figs had been rubbed; and the richer medium supplied by the process of oil painting, discovered by Jan van Eyck about 1410, was not introduced into Italy until about 1420. Taddeo Gaddi, Andrea Orcagna, and other distinguished artists maintained and continued the fame of the school of Giotto; and of these Orcagna (1323–76) is specially noteworthy, as blending for the first time Siennese idealism and delicacy with Florentine realism and force. He it was also who introduced the pictorial element into bas-relief; but this, though so splendid in effect, was of very questionable benefit to art in the result.

By this time we have arrived at the epoch of the great Dominican frescos. We have seen the origin of the Franciscan frescos. The Dominicans did not reach the summit of their power so soon as the Franciscans. Painting received its first direction from the Franciscans, and the subjects chosen by the early painters were therefore of a Franciscan character, representing either St. Francis or other kindred saintly souls engaged in actual works of charity, mercy, and love. At a later time (last half of the fourteenth century) the Dominicans began to make use of painting to enforce their doctrinal views. Whereas Franciscan pictures prompted the leading of noble lives by holding up the deeds of saints as an example, Dominican pictures were intended to enforce a large scheme of doctrine. A large class of Dominican pictures represents the “Glory of St. Thomas Aquinas,” for instance, in which the doctor sits upon his throne with his followers around him and his adversaries at his feet. Such pictures are Traini’s at Pisa and Cosimo Roselli’s in the Louvre. Pictures embodying large schemes of doctrine, painted under Dominican influence, are a set of frescos in the Campo Santo at Pisa (wrongly ascribed to Orcagna), the frescos in the Spanish Chapel, and those (by Orcagna) in the Strozzi Chapel, S. M. Novella, Florence. All these pictures make free use of allegory and symbolism. They were really designed by some learned theologian; the painter was only of secondary importance, and the names of the artists are usually unknown. Masolino (1354–1408), one of the Giottoist school, took up this great art of fresco. He began the famous works in the Brancacci Chapel, at the Carmine (Church of the Carmelites), Florence, which were carried on by his greater pupil, Masaccio, and were again returned to and completed by the elder master, Masolino.

The Pre-Raphaelites.—The next really great name that meets us in the course of the stream of art is that of Masaccio (1401–29), a man of true and original genius, who during his short career effected a great improvement in almost every department of painting. He studied works of the great sculptors Ghiberti and Donatello, and learned perspective—first specially studied by Paolo Uccello (1349–1432)—from Brunelleschi, the designer of the grand dome of the cathedral at Florence. His frescos, which still remain in the Church of the Carmine at Florence, show an immense advance on former efforts. The nude is skilfully treated, the foreshortenings are admirably managed, and some of the heads possess much of the grace and power of expression which are so remarkable in Raffaele. The

draperies, too, fall in broad natural folds, and the colouring is true, varied, and harmonious. These frescos mark an epoch in the history of art. All the leading artists for the next hundred years formed their style by studying them. They do not aim at decorative effect, as the Giottoist frescos had done. They were pictures painted for their own sake, and not in subordination to architecture. The painter aimed at making his figures noble in form and grouping them well together. He introduced a bolder modelling and stronger contrasts of light and shade. Humanity was his real subject, not any religious theme. The revived study of classical lore first began to influence art seriously in the works of this great genius. Masaccio did not live to finish the frescos in the Carmine, but died (as was supposed of poison) at the early age of twenty-eight.

Fra Angelico (1387–1455), a Dominican monk, and Fra Filippo Lippi, a Carmelite, were two of the most distinguished of the contemporaries of Masaccio. The former, a pupil of Masolino, was remarkable for the purity of his colouring and the devotional expression of his heads. At Fiesole Fra Angelico (a sweetly chosen pet name of the “angelic one,” whose real name was Guido di Pietro) painted frescos and pictures; but the walls of San Marco in Florence, his later convent, bear the chief memorials of his genius. In 1445 he went to Rome to work for the Pope. He there painted the well-known frescos in the Chapel of Nicholas V. in the Vatican. He died in 1455, and was buried in the Dominican church of S. M. sopra Minerva, where are still his tombstone and effigy. He was the last of the men whose style was directly founded upon Giotto’s; he was likewise the last purely Dominican artist. He and his brother monk, the loose-lived Fra Filippo Lippi (1412–69), a pupil of Masaccio (who was painting in the Carmine when Lippo was received), divide art into two sharply distinct styles. Fra Angelico uses beauty only as a means to an end; he is a spiritual, ideal painter; Fra Lippo loves beauty for its own sake, and delights in the truest possible imitation of the lovely secrets of nature. Fra Lippo adopted and carried on all the improvements of Masaccio, gave additional breadth to the drawing and greater relief to the figures. He was also one of the first who introduced landscape backgrounds painted with some attention to the truth of nature.

The next great painter is the delightful Florentine artist, Botticelli (1446–1510), favourite pupil of Fra Lippo Lippi, and master of the frate’s son, Filippino Lippi. (The relationship between the two Lippi marks another essential difference between the nature of the two monks Lippo and Angelico.) Sandro Botticelli knew Fra Angelico in his youth and Raffaele in his age. In him the Florentine school culminates. His engravings are all gems of the finest water. He worked much for Lorenzo de’ Medici and the Renaissance aristocracy, but with advancing life grew graver, joined Savonarola’s reforming or puritan party (I Pignoni), and especially cultivated stern religious art, which drove away patrons and brought him into bitter poverty. Another devoted follower of Savonarola was Fra Bartolommeo (nicknamed Baccio della Porta), from whom we have a splendid portrait of his noble-hearted friend, which is preserved in San Marco at Florence. To this artist (1475–1517) we owe the invention of lay figures. He was wonderfully skilful in the harmonies of line and colour, and taught much to his friend Raffaele, whom he idolized. He had resigned the pencil from religious motives till the latter persuaded him to resume it.

Greater than all these, and doubly interesting as the chief master and friend of Raffaele, is Pietro Perugino, i.e. “the Perugian” (1446–1524), whose real name was Vannucci. He was as a youth a very diligent student of Masaccio’s frescos in the Brancacci Chapel, but retained his sweet, graceful, somewhat formal Umbrian type to the end.

The posture of the legs and feet associated with his pictures, and with those of the young Raffaele—one foot turned at right angles to the other, throwing the figure into a sort of dancing master's position—seems to have had a curious fascination for him. He hardly ever omits to use it. (See also, in the National Gallery, Raffaele's "Ansidei Madonna," the figure of St. Joseph.) He travelled very greatly over Italy. Raffaele came to study with him at Perugia in 1500 during one of his temporary residences there, when he was painting the great Exchange frescos.

Perugino's greatest pupil was Raffaele, but there also is another very distinguished artist who owed his education to Perugino, namely Bernardino di Biagio, called Pinturicchio (1454–1513). This artist worked in the Sistine, but his best productions are the grand fresco series in the library at Siena Cathedral. Greater than he was Francia, whose real name was Francesco Raibolini (1450–1517), originally a goldsmith of Bologna, who took to painting rather late in life. He was a friend and, in some sense, a pupil of Perugino, but he is very original. His colouring is always fine, and his sentiment deeply thoughtful and religious. As Perugino and Fra Bartolommeo are associated with the young Raffaele so is Domenico Ghirlandajo (1449–94) with Michelangelo, whom he taught as a youth. But it is rather Luca Signorelli (1441–1523) whose style formed that of Michelangelo, if indeed any forming process can be thought of in connection with that great and original genius. All these four last-named artists—Pinturicchio, Francia, Ghirlandajo, and Signorelli—were called in to decorate the walls of the Sistine Chapel, and many of their fine frescos still remain there. Some were removed to make room for Michelangelo's "Last Judgement."

Another great name, belonging to a somewhat later period, is that of Benozzo Gozzoli (1420–98), who covered nearly the whole north wall of Giovanni Pisano's famous cemetery of the Campo Santo at Pisa with scenes from the Old Testament history, extending from the time of Noah to that of Solomon. They are still in tolerably good preservation, and form one of the most interesting monuments of the art of the fifteenth century.

It only remains, to complete this brief sketch of pre-Raffaele art, to notice a somewhat important group of painters, curiously sculpturesque in their treatment, producing pictures almost in the style of bas-relief, flourishing at Padua at this time, the chief of whom were Squarcione (1394–1474) and his great pupil Mantegna (1445–98). Mantegna was by far the greatest painter of Northern Italy whom the fifteenth century (*quattrocento*) produced. He was famous also as the first to engrave his own designs. He was the son-in-law of the elder Bellini of Venice.

The Golden Age.—The latter half of the fifteenth century saw the birth of Leonardo da Vinci, Michelangelo, Raffaele, and Titian—the four greatest names in Italian art, and the chief glories of the schools of Lombardy, Florence, Rome, and Venice, who carried the art of painting to a degree of excellence that has never since been equalled. The Lombard school was illustrated by the soft and melancholy expression, careful finish, and graceful colour of Leonardo da Vinci, Bernardino Luini, Marco d'Oggione, and Sodoma, his chief followers, and by the exquisite harmony of colour and masterly chiaroscuro that pervades the works of Correggio at Parma; the school of Florence was chiefly remarkable for its learned and accurate design; that of Rome for its power of expression; and that of Venice for its true, rich, and brilliant colouring. A fifth school, founded at Bologna at a later date by the Caracci, attempted, and with some degree of success, to unite in itself all the excellencies of the various schools that had preceded it. But the decay of Italian painting had already begun, and after the death of the Caracci and their greatest followers—Domenichino, Guido, and Guercino—the decline became rapid and irretrievable. The period between the

birth of Leonardo in 1452 and the death of Guercino in 1666, embraces nearly the whole of the great era of painting in Italy. All before is growth; all beyond is decay.

Leonardo da Vinci (1452–1519), the earliest of the four great masters above mentioned, was endowed with marvellous gifts. He was the son of a Florentine advocate, and possessed beauty and strength in no common degree. He could bend an iron horse-shoe and roll up a brass rod into a screw. He was painter, architect, sculptor, mathematician, engineer, chemist, anatomist, poet, and musician; and perhaps this many-sidedness prevented his attaining to that high excellence as a painter which he might otherwise have reached. His finest works, too, have been singularly unfortunate. The great battle cartoon which he painted in competition with Michelangelo was destroyed by an envious artist. His grand model of a horse was broken while it was being carried in procession previous to being cast in bronze; and his famous picture of the "Last Supper" was first sullied by the smoke of the refectory of the convent in which it was painted, then had a doorway driven through it, was then spoiled by bungling restorers, and last of all ruined by the troops of Bonaparte.

Michelangelo (1475–1564), like his great rival and contemporary Leonardo, was architect, sculptor, anatomist, and poet, and excelled in all. He was a stern, pure, solitary, self-reliant man, devoted to art, his only mistress, and he accomplished an almost incredible amount of work. He could study anatomy in the cell of a cloister alone with the dead at the mid hour of night, and could spend years on the scaffold below the vault of the Sistine Chapel among his prophets and sibyls, shut out from communion with the lower world. His sculptures possess immense passion and force, differing from the pure ideal of the Greeks, but original, powerful, and suggestive. His is the grandest soul that ever shone through painting. His best pupils were Venusti, Sebastiano del Piombo, and Volterra.

Raffaele (1483–1520) had more of the Greek sentiment of beauty than any other modern artist. He had a noble and beautiful mind, enshrined in a fair outward appearance. He was born among the laurel woods of the Umbrian mountains, and educated in the school of Pietro Perugino, where he acquired the somewhat sentimental manner that characterizes it. But he came, while yet a youth, to the stirring life of Florence, at the very time when the two grand cartoons of Michelangelo and Leonardo were exciting the admiration of Italy, and their influence may be traced in his later style; for he had the faculty of appropriating to himself the style of each great master with whom he was brought in contact, and adding to it a grace and charm peculiarly his own. The paintings in the halls of the Vatican, the famous cartoons at present in the South Kensington Museum, a number of beautiful Madonnas, the "Transfiguration," and a variety of other noble works, completed within the short space of twenty years—the utmost term of the artist career of Raffaele, who died at the age of thirty-seven—have made the name of this gifted painter a household word in the mouth of all lovers of art. The grand "Ansidei Madonna" of Raffaele, added to the National Gallery in 1885 at a cost of £70,000, is still under the Peruginian influence. Nevertheless, on account of the exquisite finish and the perfect state of preservation, it is his finest work next to the "Madonna di San Sisto" at Dresden, a later production, and which, taken altogether, is probably the most beautiful picture ever painted.

Titian, as we English name Tiziano Vecelli (1477–1576), was born of an ancient family in a picturesque district to the north of Venice. His long life extends over the whole of the greatest period of Italian art. The early death of Giorgione, his fellow-pupil in the schools of the Bellini (1476–1511), who might have equalled or surpassed him, left him without a rival. He became the finest colourist

and the most popular portrait painter in Italy. Popes, emperors, princes, senators, celebrated beauties, contended for the honour of being immortalized by his magic pencil. The churches and picture galleries of Venice still contain some of his noblest works—among them the "Assumption of the Virgin," which, in addition to the charm of colour peculiar to this master, possesses every other artistic excellence, and deservedly ranks among the greatest pictures in the world. Titian is the first of all colourists. In delicacy and purity Correggio (1493-1534) is equal to him, but Correggio's colour has not the same warmth and gusto in it. Titian's flesh colour partakes of the glowing nature of the climate and of the luxuriousness of the manners of the country. He represents objects not through a merely lucid medium, but as if tinged with golden light.

It is necessary here to interpolate an account of Venetian painting before Titian, and to complete the account of the school after his time. The Venetian school began with Antonello da Messina (1440-93), who has the honour of introducing into Italy the improved methods of oil-painting invented in the Netherlands by the Van Eycks, as presently to be noted. The National Gallery (a very representative collection, by the way) possesses examples by this master. Jacopo Bellini soon rose to eminence in the new art, and having married his daughter to the Paduan artist Mantegna, introduced the fine designs of the latter into Venetian art. The sons of Jacopo, Gentile (1427-1507) and Giovanni Bellini (1464-1516), soon ranked among the greatest painters of Italy. Our famous art-critic Ruskin at one time inclined to place Giovanni Bellini as the first painter of the world, a verdict subsequently changed in favour of Tintoretto. Titian and Giorgione were pupils of these great Bellini brothers; and contemporary with them, or a little later, at Venice were the splendid colourists Palma Vecchio (1480-1528), Paris Bordone (1500-71), of whom the National Gallery possesses an unrivalled specimen, Pordenone, Bonvicino, and the fascinating portrait painter, Giovanni Battista Moroni (1510-78), the magnificent pictures by whom in the National Gallery show him to be Titian's only rival in this respect.

But greater than the last-named are two masters a little later in date. The first is Jacopo Robusti (1518-94), called Tintoretto, a pupil of Titian, and painter of the splendid "Paradise," a vast canvas 34 feet high by 74 long, which fills the end of the great Council Chamber in the Doge's Palace at Venice. His works show that his reputation of being one of the most rapid painters who ever lived must have been well deserved; but there is at the same time no evidence of hurry. His admiring contemporaries said of him that he had "the design of Michelangelo and the colouring of Titian," but this is perhaps going too far. It must be admitted, however, that like Correggio he has no mean claims to be admitted to a level rank with the four greatest masters of the world. The second of these great later Venetians is Paolo Veronese (i.e. of Verona), whose family name was Caliari (1528-88), a magnificent work by whom is in the Louvre at Paris ("Marriage at Cana"), and a very fine painting also ("Alexander with the family of Darius") in our own gallery. His colouring is wonderfully luminous and rich. Jacopo da Ponte, called Bassano (1510-92), is also a famous Venetian artist of this later period.

This completes the present cursory account of the magnificent *cinquecento* period, the "golden age" of Italian painting, and it is necessary to turn to the development of the art in other countries. Summing up, we may observe that form, design, and expression have reached their highest limit as yet in the Roman and Florentine schools under Michelangelo, Lionardo, and Raffaele; that no colouring and chiaroscuro have ever since rivalled those of Titian, Correggio, and Paolo Veronese; that spiritual beauty

reached its acme in the works of Raffaele, and corporeal beauty in those of Titian; and that in Raffaele, Titian, and perhaps Moroni, portraiture gained its highest honours. Landscape as yet was quite subordinate.

Teutonic Art.—We have now to glance at painting in Northern Europe during the middle ages. The central school of early Flemish painting was Bruges, then one of the chief marts of commerce and one of the wealthiest cities in Europe. Its early records are meagre and scanty, but the first painters, such as Meelior Broederlam, appear to have been feeble in drawing and defective in colour and chiaroscuro. The glories of the school of Bruges are the two illustrious brothers Van Eyck. In them it culminated, and after their death rapidly declined, the mantle of their genius not descending upon any of their scholars or successors. Hubert (Huibrecht), the elder brother, was born at Maaseyck in 1366, and died in 1426. His greatest work is the altar-piece in the Cathedral of St. Bavo at Ghent, known as the "Mystic Lamb," at which he worked in conjunction with his brother John, who finished it after his death. John was much younger than Hubert, and was born at Maaseyck between 1382 and 1386, and died at Bruges in 1440-41. He was generally supposed to have been the inventor of oil painting, or rather of those improvements which brought it to the rank of a perfect medium for painting; but recent writers who have carefully examined the subject are of opinion that the merit of his great revelation in art should be shared with his brother Hubert. Antonello da Messina, the connecting link between the schools of Bruges and Venice, Roger Van der Weyden (1399-1461) and his famous pupil Hans Memling (1430-95), the most suave, graceful, and mystical of the early Belgian masters, were the greatest followers of the Van Eycks. Quinten Matsys (1466-1531) and Mabuse (1470-1532) carried forward the art at Antwerp. Another great name in early German painting is that of Albert Dürer (1471-1528). He possessed copious invention and great powers of design, and was perhaps even more distinguished as an engraver than as a painter. His engravings were highly esteemed in Italy, and copied at Venice by the celebrated Marc Antonio. Raffaele himself greatly admired them, and lamented that such a genius had been educated in a country where the want of proper models and fine works of art prevented his attaining to the highest excellence. He was very friendly with Giovanni Bellini when he visited Venice in 1505, and was warmly pressed to stay there by the Doge and senators. Contemporary with Dürer was a master to whom English art owes more than to any other. This was Hans Holbein (1497-1543), the son of another artist of the same name, not only the greatest German exponent of the realistic school, but one of the greatest portrait painters of any age. Looking at Holbein's hard, almost unimaginative work (or what is at least apparently so, on a first view), one refuses to believe that Raffaele was already a promising lad at work at his art when Holbein was born, for the German's art has so archaic an aspect. It is nevertheless splendid work, which wins irresistibly upon the student of it by its sheer faithfulness. We have numerous examples of the master, for much of Holbein's life was spent in England, painting for Henry VIII. and his court. His small book of woodcuts called the "Dance of Death" is quite unique: its felicity is unparalleled, and it is so wonderfully fine as to have no rival. Another contemporary of Dürer, with a like love of the fantastic and grotesque, was Lucas Cranach (1472-1553), a native of Franconia, who loved huge canvases. Some of our best portraits of Luther are from the pencil of this artist, who was a firm friend of the great reformer. After these great men the art rapidly declined in Germany.

The Eclectics.—In Italy, after the splendours of the great age, came a rapid decline. The only serious attempt to stay the downward progress was at the school of Bologna,

founded by Lodovico Caracci (1555-1619), and his two cousins Agostino (1557-1602) and Annibale Caracci (1560-1609), the last being infinitely the greatest painter of the three, but the first the finest teacher. Their greatest pupil was Domenico Zampieri (1581-1641), commonly called Domenichino, whose glorious canvas of "The Last Communion of St. Jerome" in the Vatican, had he never painted another line, would suffice to immortalize him. Closely approaching Domenichino in merit is the graceful charming painter Guido Reni, whose ceiling-piece, "Aurora and the Hours," in the Rospigliosi Palace at Rome, is perhaps as often reproduced and as much admired as any painting in the world. The "Ecce Homo" in the National Gallery is also a very favourite work of the master. Later artists of the school, commonly called the Eclectic School, but of not nearly the same merit, are Albani, Barbieri, Salvi, and the luscious Carlo Dolci.

At Naples there grew up at this time what is called the Naturalistic School, the leader of which was Michelangelo da Caravaggio (1569-1609), a very fine painter; contemporary with whom was Ribera (1588-1656), called "Lo Spagnoletto," on account of his Spanish birth, and who was succeeded by Salvator Rosa (1615-73), the lover of battle scenes and brigands. At the close of the century Pietro da Cortona (1596-1669), by his tricky effects of colour and of lights, effectually destroyed what little taste was left in Italy. So swiftly did Italian art perish from its greatness. At Venice two curious highly realistic painters arose later, Canaletto, Antonio Canal (1697-1768), who painted the architecture of Venice with the fidelity of a photograph and yet with a pleasing artistic effect, and Francesco Guardi (1712-93), far inferior to the former. Battista Tiepolo (1693-1770) often put in figures for Canaletto with a vigour, dash, and brilliancy curious in the last survivor of a great art. A pair of pictures by this artist, of considerable merit, were added to the National Gallery in 1885.

Flemish Classical School.—Two great artists of a magnificent revival now demand our notice—Peter Paul Rubens (1567-1640) and Antoon Vandyck (1599-1641). The superb colour, masterly composition, and power of handling of Rubens attract admiration to his paintings in spite of their faults, such as coarseness of form and want of beauty in his female characters, and absence of poetry in his men and children. His animals, particularly lions and horses, are admirable; and there is a facility and airiness about his landscapes which is highly to be admired. His incorrectness with regard to outline seems to proceed more often from haste and carelessness than from inability, and in his greatest works there are naked figures equally excellent in drawing as in colouring. Sir Joshua Reynolds well says of him, "that those who cannot see the extraordinary merit of this great painter, either have a narrow conception of the variety of art, or are led away by the affectation of appreciating nothing but what comes from the Italian school." Jacob Jordens (1593-1678) was Rubens' chief friend and frequent collaborator. Among the pupils of Rubens, Vandyck, justly characterized by Sir Joshua Reynolds as "the first of portrait painters," occupies the foremost place. His magnificent English works, done for Charles I., make him peculiarly interesting to us. Perhaps the finest is the large equestrian portrait of the king, 12 feet high, added to the National Gallery in 1885 at a cost of £17,500.

Dutch School.—During the seventeenth century a number of eminent painters flourished in Holland, who carried the mere technical qualities of art to a high degree of perfection. Beyond them all towers Rembrandt Van Rijn (1607-60). He carried the management of chiaroscuro to the utmost point of power that has ever been attained, so as to make us forget the frequent defects of mean forms and commonplace faces. He admitted but little light, and

gave to that little unrivalled brilliancy. The colouring of some of his pictures, such as that of Christ in the "Elevation of the Cross," cannot be surpassed. His etchings are admittedly without rivals. He produced some distinguished scholars, such as Gerard Dow and Ferdinand Bol. But the rest confined themselves to ordinary subjects, and did not attempt the grand style of biblical and historical painting that has immortalized the great masters of the best era of Italian art. Among them we may mention, as genre painters, Jan and Pieter Brueghel, Adrian Brouwer, Karel du Jardin, Philip Wouverman, Adriaen Van Ostade, Paul Potter, Jan Steen, Gabriel Metsu, David Teniers, and Gerard Terborch; in landscape and marine pieces, Ludolph Backhuysen, William Van de Velde, N. Berchem (or Bergheem), Jan Both, Albert Cuyp, Jacob Ruysdael, and Meindert Hobbema; in architecture, Van der Hagen, Pieter Neefs, Hendrick Van Steenwyck; in fruit and still life, Jan de Heem, Melchior d'Ondecoeter, Jan Van Huysum, Jan Weenix, Wynants, and Adrian Van Utrecht.

Spanish School.—No less than three centuries elapsed from the revival of painting in Italy by Cimabue and Giotto before the great schools of Spanish painting, those of Andalusia, Castile, and Valencia, acquired any definite existence. One great cause of this was that the history of Spain had been a perpetual crusade during the eight centuries that intervened between the fatal battle of the Guadalete, when the Gothic king and the flower of his chivalry fell under the Moslem scimitars, and the capture of Granada, the last stronghold of the Moors. During this stormy period war was the universal occupation, and the arts of peace were neglected and despised. It was only when the Moors had been subdued, Spain united under one monarchy, a new continent discovered, and the wealth of Mexico and Peru poured upon the peninsula in a golden stream, that the Spaniards began to admire the fine arts, and to devote themselves to their cultivation. The monarchs of the house of Austria were somewhat slow in extending their patronage to native art. Charles V. and Philip II., however, chiefly employed foreigners; and it was not until the time of Philip IV. (1621-65) that the merits of the Spanish artists were recognized and appreciated. Velasquez, Murillo, Zurbaran, Alonso Cano, the great luminaries of Spanish art, were all employed, protected, and munificently rewarded by Philip, whose peculiar glory it was to have discovered and remunerated talent, both in the provinces and in the capital, and to have promoted the artistic union of the three kingdoms of Castile, Valencia, and Andalusia. The character of Spanish painting was essentially religious. Velasquez (1599-1660) is almost the only great Spanish artist whose works are not of a devotional character. He was appointed court painter at an early age, and was constantly attached to the service of the court, so that he was chiefly employed upon secular subjects, and only upon rare occasions painted a devotional picture for a royal oratory or for a convent; yet even his style is imbued with the gravity which characterizes the Spanish character, and which is especially distinctive of the Spanish pencil. As a portrait painter he has scarcely been surpassed; and his "Surrender of Breda," painted for the palace of Buen Retiro, may well bear a comparison with the greatest historical works of the Italian school. The paintings of Murillo (1618-82) are universally admired for their agreeable colour, harmonious tone, and power of expression; and his picture of the Assumption, known as the "Virgin of the Crescent," bought some years ago by the French government, fetched the highest price at that time ever given for any picture, ancient or modern. Most people are inclined, however, to love Murillo not so much for the grander works of his later years as for the hurried pieces painted really for a scanty subsistence when he was young and very poor. These are the delightful beggar boys who flash their teeth and munch their melons amidst their rags,

the quintessence of a careless life in the sun. Other Spanish painters of eminence are Ribalta (1560-1628), who learnt his art in Italy, and Ribera his pupil, who eventually deserted to Italy and became one of the Neapolitan school. Pacheco (1571-1654) is noteworthy as having opened a school at Seville which attracted young Velasquez. The latter became not only Pacheco's pupil but his son-in-law. Another master of Velasquez was the enigmatic eccentric painter Herrera (1576-1656), who always worked in a sort of frenzy with intervals of gloom. He was at last abandoned by almost everyone as unfit to live with. But his works show real genius. Francesco de Zurbaran (1598-1622) is interesting to Englishmen because of the most remarkable figure of a monk holding a skull, in prayer, which startles visitors to the National Gallery. A painter much esteemed in Spain, but little known out of it, as his works are all in his native country, is Luis de Morales, called *El Divino* (1539-86), to whom Philip II. was a really generous patron.

French School.—This need not detain us long. The judgment passed upon it by Henry Fuseli is in the main a correct one. "The seeds of mediocrity," he says, "which the Caracci had attempted to scatter over Italy, found a more benign soil and reaped an abundant harvest in France: to mix up a compound from something of every excellence in the catalogue of art was the principle of their theory and their aim in execution. It is in France where Michelangelo's right to the title of a painter was first questioned. The fierceness of his line, as they call it, the purity of the antique, and the characteristic forms of Raffaele, are only the road to the academic vigour, the liberated style of Annibale Caracci, and from that they appeal to the model; in composition they consult more the artifice of grouping, contrast, and richness, than the subject or propriety; their expression is dictated by the theatre." M. Charles Blanc, in his *"Histoire des Peintres français au 19me Siècle,"* admits that "the French school, as a whole, has had but feebly the sentiment of nature and the religious sentiment;" but he claims for it the merit of being a great historical school. Even its landscape, as in Nicolas Poussin, is historical, and serves merely as a framework for the human actors. The greatest names in French painting, previous to the Revolution, are—Nicolas and Gaspar Poussin, Claude Lorraine, Pierre Mignard, Sebastien Bourdon, Charles Lebrun, Eustache Lesueur, Greno, Watteau, Joseph Vernet. During the reigns of Louise XV. and Louis XVI. art in France was in a most corrupt and degraded state, from which it was raised by the vigorous hand of David (1748-1825). He devoted himself to the study of the antique, and brought about a strong pseudo-classical reaction, which lasted until about 1820 or 1825, when it was superseded by the romantic school, whose chief exponents were Louis Gérard (1790-1824), Leopold Robert (1791-1835), Paul Delaroche (1797-1856), Ary Scheffer (1795-1858), the Dutchman Corot (1796-1875), Delacroix (1799-1863), and Jean François Millet, the peasant painter (1815-75). Under these men modern French art has risen to a great pitch of technical excellence. In many respects the French painters stand at the head of their art in the present day.

Painting in England.—We shall conclude our sketch of the various schools of painting by a brief notice of the pictorial art in our own island. Previous to the time of Henry VIII. painting had made but little progress in Great Britain. Artists were held in little esteem, and ranked with the menials of the court; and their works were worthy of their degraded condition. On the accession of Henry a change for the better took place. He was young, learned, gallant, liberal, and rich, and ambitious to rival the continental courts in splendour and magnificence. He invited foreign artists to his court; and Torreggino and Holbein were well employed as portrait painters by the monarch and his

nobility. Sir Antonis Mor came over to paint Queen Mary. Federigo Zuechero and Marc Garrard were encouraged by Elizabeth, and the unfortunate Charles I. was one of the most liberal and discriminating patrons of art that ever lived. He bought the splendid collection of pictures belonging to the Duke of Mantua for £20,000, acquired the noble cartoons of Raffaele by the advice of Rubens, and succeeded in forming one of the finest picture galleries in Europe. Rubens, Vandyck, and Lely all painted for the king. The colossal equestrian portrait of Charles by Vandyck, added to the National Gallery in 1885, is a magnificent example of the master. Unluckily, the whole of this precious collection was sold by the Parliament of 1613; and an order was issued, dictated by the gloomy and ignorant fanaticism that distinguished the Puritans in artistic matters, "that all pictures which had the representation of the Saviour or the Virgin Mary in them should be burnt." Misfortune, indeed, seemed to pursue this noble collection; for, after the Restoration, the fire which consumed Whitehall utterly destroyed that part of it which had been replaced in the palace. Sir Peter Lely's facile and graceful pencil found ample and profitable employment in portraying the frail beauties of the gay court of Charles II.; and his successor, Sir Godfrey Kneller, also acquired fame and fortune as a portrait painter. Sir James Thornhill (1676-1734) deserves notice, not so much for the merit of his performances, which is but mediocre, but from the fact of his being the first Englishman who attempted the lofty walk of historical painting. He was employed to decorate the dome of St. Paul's Cathedral and the hall of Greenwich Hospital. He received but 40s. a square yard for these works; but he was knighted by George I. and elected to represent his native town in Parliament. A man of great and original genius arose in the person of Hogarth, Thornhill's son-in-law (1697-1764), who has exhibited with a truth, power, and vividness seldom surpassed, the follies and vices, the good and evil of the times in which he lived, and has thereby taught a great and useful moral lesson to all future times. The English school of landscape painting, since so fruitful and productive, was shortly after this period founded by two great artists, Wilson (1714-82) and Gainsborough (1727-88). The former delighted in scenes of classic and poetic fame; his thoughts were ever dwelling among hills and streams renowned in story and song; and he loved to visit ruined temples and walk over fields where great deeds had been achieved. His landscapes are bathed in the glowing sunshine of Italy, where he spent some of the best years of his life. Gainsborough's landscapes, on the other hand, are true and exquisite representations of the sylvan scenery of England. He delighted in wooded glades and verdant swards, brooks murmuring along their stony channels, and picturesque cottages sheltered by umbrageous trees; and in all a deep pervading human sympathy unites us with the subject, for these delightful scenes are no solitudes, but are animated by labourers and wayfarers or by blooming peasant children, full of rustic grace and untamed wildness. As a portrait painter Gainsborough was only second to his great contemporary Sir Joshua Reynolds (1723-92), the first president of the Royal Academy of London (established by George III. in 1768), and the first of British artists and critics, whose famous "Discourses" did as much as his magic pencil to improve and elevate the art of painting in England. These were followed by Benjamin West, Copley, Barry, and Romney, to whom Lady Hamilton so often sat as a model, Wright, Fuseli (Fussey), William Blake, and Morland. During the present century Sir Thomas Lawrence, Macleise, Dyce, Etty, and other eminent artists, have honourably distinguished themselves in portrait and historical painting; in landscape, Turner proved himself uncontestedly the greatest landscape painter who ever lived, while Crome, Constable, Harding, Callcott, Stanfield,

Copley Fielding, Creswick, Danby, David Roberts, and a host of other great names, have ably sustained the honour of the English school; in genre painting we have Sir David Wilkie, Mulready, and Leslie; while Sir Edward Landseer, Ward, and Lance, in animal painting and still life, safely challenge comparison with the best works of the Dutch school of the seventeenth century. The water-colours of David Cox, De Wint, Samuel Prout, William Hunt, Samuel Palmer, Francis W. Topham, and Frederick Walker are also among the finest productions of English artists only lately living among us. In fact, in the delicate and refined art of water-colour painting England at present is far ahead of other nations.

The foundation of the National Gallery in 1824 was of great assistance to the study of art. Young as it is this collection is already remarkable for many great treasures of painting, but more particularly for its completeness as a representative collection. Hardly a master of real eminence is unrepresented, and of most there are excellently characteristic examples.

The art of painting expresses itself by means of form and colour, of which the first is the principal, and the second, though of much importance, the subordinate and accessory. Its aim is the representation of the true appearance of objects in such a way as to make the greatest possible impression on the spectator. It may be conveniently divided into the five branches of invention, composition, design or drawing, colouring, and chiaroscuro. The first of these is the most divine in its origin, the most incommunicable, the most peculiar to great genius, the least subject to rules. How to improve it many books can teach us; how to obtain it none. Yet without some portion of this divine element the painter is little better than a mere copyist. But although invention be thus a divine gift, it is no less true that it requires to be sustained and supported by solid judgment and extensive information. Successful invention demands the possession of a large fund of ideas; and those artists who have been most distinguished by the fertility and felicity of their invention—such as Lionardo da Vinci, Michelangelo, and Raffaele—were thoroughly acquainted with all the knowledge of their time in everything that related to art. Sir Joshua Reynolds in his twelfth discourse recommends "that young students should not presume to think themselves qualified to invent till they were acquainted with those stores of invention the world already possesses, and had by that means accumulated sufficient materials for the mind to work with." And elsewhere he says, "It is indisputably evident that a great part of every man's life must be employed in collecting materials for the exercise of genius. Invention, strictly speaking, is little more than a new combination of those images which have been previously gathered and deposited in the memory: nothing can come of nothing: he who has laid up no materials can produce no combinations."

Composition is the arrangement of the various component parts of a picture so as to form a consistent and harmonious whole. It is closely connected with invention. It is generally determined upon in the first sketch for the picture; and if it be not originally good, no amount of finish in detail or excellency in colouring will produce a successful painting. Composition should be natural and suited to the subject. Raffaele's composition in his best works is distinguished by simplicity and artlessness. His figures seem to have been grouped by nature rather than arranged by art. The "School of Athens" in the Vatican, and the "Death of Ananias" and the "Sacrifice at Lystra" among the cartoons afford good examples of the masterly qualities of his composition. In composition there ought to be a principal mass on which all the other portions should be dependent. The general shape of this may be greatly varied; and care should be taken to avoid too great regularity and sameness of parts and forms.

We now come to design or drawing, the foundation and essential of all really good art. Sir Joshua Reynolds says, "He who is capable of delineating fine forms, even if he can do nothing more, is a great artist." And Annibale Caracci used to tell his scholars to make first of all a correct outline, and then, whatever they did with the middle, it would still be a good picture. Design was especially studied in the schools of Greece, and hence our students are still sent to the antique statues in order to acquire a standard of form. The drawing of the Italians, too, from the days of Masaccio to those of the Caracci, was masterly; and design was the distinguishing excellence of the two chief schools of Italy—those of Rome and Florence. The characteristics of good design are correctness and style; of bad, incorrectness and manner. The sciences of anatomy and physiognomy, and the laws of symmetry and proportion, ought to be thoroughly mastered by the young artist who aspires to be a great designer. He ought to cultivate fidelity of eye and obedience of hand, so as to be able to copy with purity and precision any object presented to him.

The union of agreeable colouring with correct design is necessary to make a good painter; the union of these with all other pictorial excellencies is requisite to form a great one. Colour lends an inexpressible charm to drawing. Faces and forms glow with life and beauty, and the varied robe of nature is reproduced on the canvas. A fine eye for colour, and delicate perception for its infinitely varied tints and gradations, is in a great degree a natural gift; and though rules may be given which will prevent the painter from falling into gross mistakes in his colouring, it is impossible to form a great colourist by any system of rules. Colouring is the decorative part of art. Its great object is the production of beauty. Harmony is a quality indispensable in all good colouring, by which is meant such a degree of relation or congruity between two or more colours as will best support and develop each other's beauties. Colours should be so treated as to produce unity and breadth of tone, the opposite of which is gaudiness or harshness. Tone implies a degree of transparency which, in oil painting, is easily attainable by the process termed glazing, or passing a transparent colour over a previously prepared tint. In water colours most of the pigments used are transparent, and the proper method of using them proceeds upon the principle of working entirely with transparent media. Pictorial harmony may be obtained in various ways, one of the most obvious and common of which is to have a balance of warm and cold colours in the picture. But with either cold or warm tints in excess a pleasing picture may be produced. Ruysdael, Hobbema, Teniers, and Ostade seldom employed glaring colours, while Cuyp and Both as seldom used cool tints; and yet their pictures, though painted on such opposite systems, afford excellent examples of pictorial harmony.

The last of the departments of painting that we have to consider is the important one of chiaroscuro. The term chiaroscuro, in its primary and simplest sense, means the division of a single object into light and shade, and in its widest compass comprises their distribution over a whole composition. It has the power of creating space, giving substance to form and place to figure; but it should always be made subservient to and illustrative of form, character, and expression, and not ostentatiously paraded, as it has too often been, and elevated from the rank of a subordinate into that of a principal. It was not until two centuries after the revival of art in Italy that Lionardo da Vinci explained and developed chiaroscuro as a principle of beauty in single figures and of effect in composition. Correggio, Giorgione, Titian, Paolo Veronese, the Caracci and their principal followers, Rubens, and Rembrandt, afford admirable examples of the successful application of chiaroscuro. Many of the Dutch painters also particularly excelled in their management of light and shade, such as Jan Steen,

Teniers, Ostade, and many others. Sir Joshua Reynolds, when at Venice, adopted the following simple means of acquiring a knowledge of the system of *chiaroscuro*, as adopted by the great masters of that school:—Whenever he noticed a remarkable effect of light and shade he took a leaf from his pocket-book and darkened every part of it in the same gradation of light and shade as the picture, leaving the white paper untouched to represent the light, and this without any attention to the subject or to the drawing of the figures; and he recommends this practice as being sufficient, after a few experiments, to give the student a good idea of the method of these great men in the management of light and shade. Breadth is an essential quality of *chiaroscuro*, and without it the highest finish is labour in vain. There should be a principal mass of light and dark in the picture, to which the other lights and darks introduced should be subsidiary and subordinate, and the shadows and lights should be made to harmonize by the judicious management of the middle tint. It is difficult to lay down any precise rule for the relative magnitude of the masses of light, shadow, and half-tint in a picture, as these vary with the character of the subject and in the practice of different schools; but an ingenious French writer has observed that it was the general practice of those painters who best understood and most successfully employed *chiaroscuro*, to make the mass of middle tint larger than that of the light, and the mass of shadow larger than the light and half-tint united.

It remains to add a few remarks as to materials and methods. From the foregoing article it is evident that the oldest kind of painting is fresco, and that tempera and encaustic painting followed much later. All these are methods of water-colour painting. [See FRESCO; TEMPERA.] A fourth kind, which is what we now distinctively call water-colour painting, invented and especially followed by English artists, arose out of tinting pencil drawings with washes of colour. (It is still very usual to call all works in water colour "drawings.") Later on these washes were made more definite in colour, and the feeble pencil outline was replaced by the Indian-ink line drawn by a reed pen after, not before, the colouring. Eventually the simple art developed into the magnificent productions of Turner and Herkomer, rivalling oil painting in force. See WATER-COLOUR PAINTING.

Oil painting, now the chief method followed, is far younger than water colour, *i.e.* fresco, &c. In all essentials it remains much as it was left by the Van Eycks. The various colours [see PIGMENTS] used to be finely pulverized and kept in bladders for use, the apprentices or students grinding down a little in oil as required. They are now ground up by the colourman to a fine thick paste with poppy-oil or with linseed-oil, and kept in tubes well closed. A little colour is squeezed out of the tube on to the palette, and the artist then thins it down to a workable consistency by dipping his brush in whatever medium he may prefer. Simple linseed-oil is preferred by many; some prefer pure paraffin oil, others add mastic, copal, or amber, and others use drying compounds, "siccative," and the like. Equally various are the methods of laying on the colour, some painting with comparatively soft brushes and many thin, fluid, even coats; others plastering on the paint in great heaps, using large brushes, and not unfrequently the palette knife. Titian preferred to use his finger in many cases, especially with the flesh tints.

Certain technical terms are met with very frequently which describe a few of the commonest practices. Painting in thin washes of colour, so that the ground can be seen through it, as if a coloured glass were held there, is called *glazing*; it is at once the most effective and the most difficult manner. The greatest painters obtain their delicate effects by glazing their final touches in fine tints over the picture already completed in thick painting. Turner often

glazed in water colour, with a fatal sacrifice of permanency, so that many of his most enchanting effects can now only be read about: they are no longer to be seen. Glazing with opaque colour, passing thinly and lightly over the painting beneath, is called *scumbling*. High lights are usually obtained by thick masses of colour, catching the light on their edges, and therefore standing out far more vividly than flat tints of the same brilliancy would do. This is called *impasto*. Many painters work all their light in *impasto* and all their shadows in smooth painting, gaining great solidity of effect, but at the expense of smoothness and purity. Heavily impasted pictures quickly deteriorate, from the action of weather and dirt upon their exposed edges of colour.

Finally, there are two sharply opposed methods of work. One is to indicate at first the desired result and approach it gradually by repeated touches of colour, each state of the picture being stronger than its predecessor; this is the method of Lionardo and Fra Angelico, and even more especially of those painstaking Dutch artists for whom no labour was too great. The method of Tintoretto, of Paolo Veronese, and of Rubens, on the other hand, was to dash at their huge canvases, and fling, as it were, the completed pictures bit by bit upon them. This of course is the only method possible for such extraordinary rapidity of execution as these men showed. It is perhaps unnecessary to say that the great bulk of artists do not spend the infinite time required by the first style, nor have they the extraordinary precision of idea involved in the second.

PAIR, a parliamentary term, when two members of different political opinions come to a mutual agreement to withdraw from all divisions of the House for a certain period, thus neutralizing each other's absence.

PAISIELLO, GIOVANNI, was born at Tarento in 1741, and entered the Conservatorio St. Onofrio at Naples. He there produced, among other compositions, a comic interlude, which in 1763 procured for him an order to compose his first opera for the Teatro di Marsigli at Bologna. In 1776 he entered into the service of Catharine II., and continued in Russia nine years, where he produced several important works. His "Barber of Seville" was so popular that when Rossini set the same play the audiences for some time refused to give him a hearing. Time brings its revenge, for probably no one living has ever heard Paisiello's opera, while there are few musicians not intimately acquainted with Rossini's *chef d'œuvre*. On his return to Naples the king appointed Paisiello his maestro di capello. On the revolution at Naples in 1799 Paisiello accepted the office of national director of music; but at the restoration of the royal family he was suspended from all his public functions. In about two years, however, he was reinstated. Shortly after this he accepted an invitation from Bonaparte to visit Paris, and was appointed his maître de chapelle. He returned to Italy in 1805, and served both King Joseph and Murat. He naturally was in great disfavour when the Bourbons returned, and lost nearly everything. His spirits gave way under the blow, and he died at Naples in 1816. He is now best known by his pretty air "Nel cir non pin mi sento" ("Hope told a flattering tale"), to which Beethoven wrote some exquisite variations for the pianoforte.

PAISLEY, a municipal and parliamentary borough in Renfrewshire, Scotland, situated on both banks of the White Cart, about 3 miles above the junction of that river with the Clyde, 48 miles W. by S. from Edinburgh, direct distance, and 8 miles W.S.W. from Glasgow by railway.

Paisley is generally identified with the Roman station *Pandura*. In 1163 a priory was founded on the eastern bank of the White Cart, and a small town arose on the opposite bank of the river, which James IV. in 1488 erected into a burgh of barony, under the superiority of the abbot of Paisley. Like Glasgow, the town of Paisley has grown up into wealth and importance since the Union,

owing in great measure to the introduction of the cotton manufacture.

The Priory of Paisley was founded by Walter, high steward of Scotland, about 1163, for a prior and thirteen monks of the Clunian Benedictines, and was dedicated to St. James, St. Mirren, and St. Milberga. This was the burial-place of the Stuart family before its accession to the Scottish throne. In 1245 Pope Honorius raised the priory to the rank of an abbey. In 1307 it was burned by the English, but restored a few years later, and considerably enlarged. After the suppression of the monasteries and the rise of the reformed religion it fell into decay, so that all which now remains of the once glorious pile is the nave of the Abbey Church, a structure in the Early Pointed style, with six noble bays and a handsome roof. This now forms the parish church, which was thoroughly restored in 1862. The nave measures 92 feet by 35 feet. The transept and chancel are in ruins, but the great north window, which is 18 feet broad and 25 feet high, and of beautiful tracery, has been restored.

Adjacent stands St. Mirren's Church, or the "Sounding Aisle," so called from its curious echo. A recumbent figure of a lady, on an altar-tomb, with hands folded as in prayer, is supposed to commemorate Marjory Bruce, mother of King Robert II.

There are several other churches, including three belonging to the Establishment, viz. the High Church, built in 1756; the Middle Church, 1781; and St. George's, 1819. The Free Church and United Presbyterians have also commodious places of worship. Paisley is a presbytery within the synod of Glasgow and Arr.

The other public buildings are the County Buildings and Prison, a block of handsome castellated edifices dating from 1818; the George A. Clark Town hall, erected in 1882, and presented to the town; Free Library and Museum, containing an interesting Indian collection, picture gallery, and observatory; the Coffee-room at the Cross; the Neilson Educational Institution; the Infirmary; and the Grammar-school, founded by James VI., for which a chaste, capacious, and substantial building was erected in 1864. There is also a government school of art, erected in 1847. In 1868 Mr. Thomas Coats of Ferguslie presented to the people of Paisley the magnificent pleasure grounds to the north of the town, the Fountain Gardens, so called from their prominent feature in the centre of the grounds, a superb Franco-Italian fountain.

The municipality is governed by a provost, four bailies, and ten councillors. By means of a short canal and improvements in the bed of the river, the Cart is navigable up to the town for vessels of 80 tons burden, and it is proposed to still further improve the navigation. The Glasgow, Paisley, and Johnstone Canal has been recently converted into a branch of the Glasgow and South-western Railway. The town is intersected by this railway's main line and branch to Renfrew, and by the Caledonian Railway, Greenock section. It is supplied by water from Gleniffer Braes, and from Rowbank, 8 miles west.

In 1707 the principal articles made here were coarse linen, chequered cloths, and Bengals, to which succeeded chequered linen handkerchiefs, and goods of a lighter texture, such as lawns. About 1725 the machinery for making white sewing or ounce thread was introduced from Holland, and this article is still made on a most extensive scale; indeed, the town may be considered the principal seat of the thread manufacture for the home markets. About 1760 the manufacture of silk gauze was introduced upon the plan practised by the Spitalfields houses, and during the greater part of the following thirty years was carried on upon a very extensive scale. The reduction in the cost of cotton goods, consequent upon the introduction of Arkwright's spinning machinery, lessened the demand for silken fabrics, and the trade of Paisley de-

clined; but it is still famous for the delicacy and beauty of its silk and other shawls, silks, muslins, and ornamental or other fancy goods. Plaids, scarfs, crapes, Persian velvets, and shoes are also made here; coal, shale, stone, iron, fire and potter's clay, lime, alum, and other useful products, are found in the neighbourhood. There are also brass and iron foundries, engineering works, tanneries, breweries, distilleries, starch-works, dye-works, bleachfields, &c. Paisley dates far back in the support of horse races. The St. James' Day races, which were originated by the bailies in 1620, are still run.

Since the passing of the Scotch Reform Act of 1832 Paisley has returned one member to Parliament. The population of the borough in 1881 was 55,627. The "Black Book of Paisley" has been ascertained to be simply a MS. copy of Fordun's "Scotochronicon." The "Charterulary of Paisley" was printed in 1832 by the Maitland Club of Glasgow. Sir William Wallace is said to have been born at Elderslie, about 2 miles south-west of the town. Professor Wilson, Alexander Wilson, poet and American ornithologist, and Robert Tannahill, the poet, were born at Paisley.

PAIXHANS, HENRI JOSEPH, a noted French artilleryman, was born at Metz, 22nd January, 1783, and was educated at the Ecole Polytechnique. He subsequently entered the army, and gradually attained the rank of general. He was member of the French Chamber of Deputies, where he delivered several important speeches, which were afterwards collected and published. He is principally known as the inventor of the Paixhans gun, and of several improvements in projectiles and gun carriages. His guns were chiefly used for shells and hollow shot, and first came into use about 1824. They were originally 9 feet 4 inches long, had a bore of little more than 8 inches in diameter, and weighed about $3\frac{1}{2}$ tons. He was the author of "Considérations sur l'Etat Actuel de l'Artillerie des Places, et sur les Améliorations dont elle paraît susceptible" (1815); "Nouvelle Force Maritime," &c. (1821), showing how small vessels might contend successfully against large ones; to which was subsequently added, in 1822, a more lengthened work under the same title, "Expériences faites par la Marine Française sur une Arme Nouvelle," &c. (1828); "Force et Faiblesse Militaire de la France," &c. (1830); "Fortifications de Paris," &c. (1834); "Constitution Militaire de la France," &c. (1819). Paixhans died 19th August, 1834, near Metz.

PALACE, a word adopted into all European languages from the Latin *palatium*, the name given by Augustus to his residence on the Mons Palatinus at Rome. In its stricter meaning it is restricted to a royal abode, but is occasionally applied to any sumptuous habitation. In Italy the term *palazzo*, taken by itself, is used for any large mansion or nobleman's house; and palaces of this class constitute, after churches, the principal architectural features of Genoa, Florence, Rome, Milan, Vicenza, Venice, and other cities, to which they impart an air of great grandeur.

PALADIN, an appellation bestowed in the mediæval romances on the warriors of Charles the Great (Charlemagne) and the knights of the olden days, and now generally used to signify a peculiarly heroic and chivalrous character. It was derived from the Roman *palatinus*. The principal dignitaries of the Byzantine court were the officers of the palace, *palatini* or *comites palatini*; whence came the Norman-French *paladin*. The principal paladins of Charles the Great, twelve of whom usually accompanied him at one time as a sort of staff, and whose adventures fill old French poetry, were the following:—Alfroy and Guillaume de l'Estoc; Astolfo; Bassin le Genevois; Fierabras; Florimart; Ganelon (a traitor); Geoffrey of Bordeaux; Geoffrey of Frisia; Guerin of Lorraine; Guy of Burgundy; Hoël of Nantes; Lambert of Brussels; Malagigi; Nami of Bavaria;

Ogier the Dane; Oliver of Genoa; and Orlando or Roland—these two being the emperor's most honoured followers: Roland was indeed his nephew—Otuel; Richard of Normandy; Rinaldo; Riolf of Le Mans; Sauson, duke of Burgundy; and Thierry of Arrennes.

PALÆOCENE, in geology, a term sometimes applied to the period more commonly subdivided into Eocene and Oligocene.

PALÆOGRAPHY. See WRITING.

PALÆOLITHIC. See STONE AGE.

PALÆOLOGUS, the Latinized form of the Greek name *Palaïologos*, a family which furnished the last Roman emperors of the East, when the seat of empire had long been at Byzantium, now Constantinople. They are often called Byzantine emperors, to distinguish them from the German emperors of the "Holy Roman" Empire. Descendants of the Palaiologi were still existing in the seventeenth century; some say that they still are to be found in France.

The interest attaching to the Palaiologi is chiefly that they were the last sovereigns of an empire which had once been so great. Constantine Palaiologos fell in 1453 on the walls of Constantinople, which he was vainly endeavouring to defend against the Turks, and with him the empire too perished, and Constantinople has been in the hands of the sultan ever since.

The family was honourably known as early as the eleventh century, when Niképhoros Palaiologos was governor of Mesopotamia. He fell defending Dyrrachium (Durazzo) against the Norman invasion of 1081. His son Georgios was an able soldier, and helped Alexios Komnēnos (Lat. *Comnenus*) to the throne of the empire in 1081. So the family continued, faithfully serving the Komnēnoi till Andronikos Palaiologos, who took the surname of Komnēnos by favour of his master, and who was Great Domestic (chancellor) under the emperors Theodoros, Laskaris, and Vatazēs. He married his relative, Irene Palaiologina, whose father (Alexios Palaiologos) had been chosen heir to the empire, and had only been prevented succeeding by an untimely death. The son of the Great Domestic, Michael, was the first emperor of the family.

Emperors.—Michael VIII. (1260–82); Andronikos II., son (1282–1328), with whom his son, Michael IX., reigned till the latter's death in 1320, and in whose reign the Turks first became dangerous; Andronikos III., the capable and wise grandson of Andronikos II., whom he dethroned (1328–41), the elder emperor retiring into a convent and dying as a monk in 1332; interregnum 1341–55, during which Ioannēs Kantakouzenos usurped the throne; Ioannēs or John VI. (1355–91), the weak and dissolute son of Andronikos III., with whom his son Manuel was associated, and who acknowledged himself a vassal of the sultan; Manuel II., son, sole emperor (1391–1425), in whose reign Bajazet besieged Constantinople; Ioannēs VII., son (1425–48); Constantine XIII., brother (1448–53), heroic ender of a degenerate rabble, slain at the taking of Constantinople by the Turks. A branch of the family held the principality of Montserrat from 1805 to 1833. Upon the marriage of a niece of the last emperor to the Czar, Russia long based a shadowy claim upon the empire of the East. Attempts were made by Michael VIII. to remove the points of difference between the churches of the East and West. The resumption of these praiseworthy efforts by John VII. was due rather to the great pressure of the Turks, and to a hope that the Pope would bring about a new crusade in his favour, than to religious zeal. The emperor appeared at the council of Florence, and in July, 1439, the union of the churches was fully accomplished by pope and emperor. But upon the return of the latter to Constantinople, the clergy, who had been considerably outwitted by the astute ecclesiastics of Rome, refused to abide by their arrangements.

PALÆONTOLOGY (Gr. *palaĩos*, ancient; *onta*, beings; *logos*, discourse) is that branch of biological science which treats of the past history of life upon the globe. Its facts and principles bear the same relation to systematic zoology and botany that those of embryology bear to anatomy; and just as the structure of an adult living being can only be understood by taking into consideration its developmental history as studied in the embryo, so the peculiar features and relationships of the existing species and races can only be elucidated by an acquaintance with what has preceded them in time. Embryology endeavours to discover the origin of the various dispositions of parts in the perfect organism, and to explain structures, whose *raison d'être* is obscure in the adult; palæontology has for its object the elucidation of the stages by which the present distribution of species and races has arisen, and the cause of the various common characters that can now scarcely be explained on examining the living groups themselves.

Palæontology, however, has a very unsatisfactory mass of materials for its basis. The only method of discovering the past history of the earth and its inhabitants is to study the rocky crust of the globe—that is, to derive information from the science of Geology; and the fossilized remains of organic bodies contained in the rocks form the sole foundation for this department of biological research. It is true, indeed, that the embryonic history of an organism often affords hints as to the successive characters of its remote ancestors, but there is a constant tendency for these embryonic stages to become as abbreviated as possible, thus obscuring most important facts, and palæontology alone can be expected to yield precise particulars on these points. From the circumstance that it is based upon fossils it is obviously intimately connected with geology, and no geological manual is regarded as complete without dealing with palæontological considerations in certain aspects. Stratigraphical geology, in fact, in its widest sense, is concerned not only with the former distribution of land and water at successive periods, but also with the distribution of life at each of those epochs; and the remarkable constancy of the order of appearance of the various faunas and floras in all parts is of fundamental importance as fixing the relative age of a formation when direct stratigraphical evidence is not available.

The imperfection of the "geological record"—as Darwin terms it—is the great hindrance to progress in palæontological knowledge; for the preservation of organisms in the fossil state, and their subsequent discovery by man, is of the nature of an accident rather than an ordinary circumstance. In the first place, plants and animals can only be preserved on finding their way to some spot where there are suitable conditions for their entombment in rock: they must either be buried in blown sands or volcanic ashes, or in the sediments beneath water. Again, there is the circumstance, that even under these conditions only those organisms that have more or less hard parts—skeletons in animals and vascular tissues in plants—will resist the tendency of percolating water to destroy all traces of them; and, at their best, these relics are very unsatisfactory when compared with the materials available to zoologists and botanists. [See FOSSIL and FOSSILIZATION.] Then there is the perplexing factor of unrepresented time; when any area is dry land far removed from great lakes or seas the preservation of specimens of its fauna and flora is quite an extraordinary accident, and whole epochs have certainly passed away in almost every part of the globe without our being able to discover traces of their living forms in the particular areas in question. DETERIORATION, in removing series of fossiliferous deposits that have already been formed, constitutes another difficulty. The METAMORPHISM of such strata has also often destroyed all the contained fossil remains. And lastly, it is important to remember that

only very few parts of the globe have hitherto been exhaustively studied, and that new forms of extinct life are constantly being made known through fresh excavations.

If it were not for such considerations as these we should expect palaeontology to furnish some idea of the beginnings of life upon the earth's surface. As facts stand, however, the pursuit is almost hopeless. If Professor H. N. Moseley be correct in his interpretation of the recent advances in the study of oceanic life, and in the embryology of shore-dwelling species (see his presidential address to the Biological Section of the British Association, 1884), it seems probable that living beings first originated in the open sea, far away from a beating surf, and then gradually adapted themselves for the more troublous conditions of the littoral zone, where breakers and tides exert their force—passing, thence, on the one hand, to the depths of the sea, and, on the other, to the rivers and the land. He thus concludes that the first tendency of living beings to develop hard structures, and to adopt a sedentary mode of existence, would make itself evident when the organisms were under the necessity of protecting themselves against the noxious influence of tidal currents and battering waves. Moreover, it is not improbable that such a change may only have taken place after the organic world had assumed a considerable degree of diversity. Now if these speculations eventually prove to be well founded, it is obvious that we can only hope for the earliest records of the rocks to tell of the time when such a change had been brought about; and so far as our present knowledge extends, there is nothing in geology and palaeontology to invalidate the conclusion. Below the base of the oldest known fossiliferous deposits there are thousands of feet of more or less metamorphosed strata, in which not a trace of organic bodies has hitherto been met with—though it must be confessed that negative evidence is worth little in an advancing science—and the earliest structure as yet interpreted as a fossil organism is the *Eozoon Canadense*, discovered by Sir J. William Dawson in the Laurentian rocks, a division of the Archæan group of Canada. If really organic, *Eozoon* must have been a huge representative of the Foraminifera, occurring in masses quite comparable to reefs, and belonging to the most specialized family of that class. While its discoverer, however, and those who have specially studied Foraminifera (e.g. Carpenter, Rupert Jones, Parker), feel confident of its true animal nature, certain mineralogists (e.g. King, Rowney) and a few biologists (e.g. Carter, Möbius) are equally convinced of its mineral origin; but it is interesting to note that there are associated with this structure a number of other indeterminable fragments that may be organic, and its real nature must therefore be regarded as an unsettled point. If *Eozoon* is a peculiar mineral, then the fossils discovered by Dr. Henry Hicks in the lowermost Cambrian rocks of St. David's (Pembrokeshire) are the earliest assemblage of organic remains hitherto disinterred from any part of the world. Here, in one stratum of red shales, there have been found four BRACHIOPODA (*Lingulella primæva*, *Lingulella ferruginea*, and two species of *Discina*) and one Entomostracæan (*Leperditia cambrensis*), and about 1000 feet above these there occur TRILOBITES—some gigantic (*Platystrophia* and *Paradoxides*), and some microscopic in size (*Microdiscus* and *Agnostus*)—two species of a sponge (*Protospongia*), two species of a pteropod mollusc (*Theca*), and also the little brachiopod, *Lingulella ferruginea*. Thus, at least, four of the eight subkingdoms into which animals are usually classified are represented in this primitive group. Indeed, it would seem that members of all the seven subkingdoms below the Vertebrata were well differentiated before the end of the Cambrian period, and some genera were far from being of a lowly or embryonic character.

Palæontology teaches that since these very remote times the world of living things has undergone a remarkable

series of transformations. The *Discina*, it is true, has survived all changes of conditions and still lives in present seas, and the existing *Lingula* is scarcely distinguishable from the lower Cambrian *Lingulella*; but vicissitude has been the predominant feature of the higher subkingdoms. The Foraminifera (by which the Protozoa are first represented) have persisted through all time with very little alteration; *Succinea* (in Britain) and *Fusulina* (in Russia and North America) contributed largely towards the formation of limestone in the Carboniferous period; the chalk is to a great extent made up of the tests of Globigerina and other forms; the extensive nummulitic limestones of the Eocene epoch owe their origin to the growth and death of myriads of coin-shaped (nummuline) Foraminifera; and beds of Ooze are now being formed beneath certain parts of the Atlantic and Pacific Oceans, mainly through the accumulation of globigerine Foraminifera. The silica-secreting class of Protozoa, commonly called POLYCESTRANS (more properly Radiolaria), though abundant now-a-days, are not known to have appeared before Mesozoic times, and they evidently did not assume much importance till the Tertiary period; thick deposits of these organisms occur in the Barbadoes and in the Nicobar Islands.

The SPONGES (subkingdom Porifera), as just remarked, are represented by *Protospongia* in the lowest Cambrian rocks, and they range apparently in undiminished numbers to the present day. The horny sponges are very imperfectly known as fossils, in consequence of the destructive character of their skeleton; but some have thought it probable that the little boring sponge *Cliona*, so frequently found at present making tunnels in oyster and other shells, had close allies even when the lower Silurian beds were deposited. The past history of the calcareous sponges is also unsatisfactory, but fossils as old as the Devonian are perhaps referable to these. The flinty sponges—of which the living "Venus" flower-basket" is a good example—are well represented in the fossil state. The "glass rope sponge," with several others, occurs in Silurian strata; many more are found in the formations succeeding the Cretaceous, where the materials for our study of this group become remarkably abundant—perhaps from the special circumstances under which most of the rocks of this age in Western Europe were formed. Ventriclelites is an important vase shaped genus in the chalk, and a stalked sponge, *Siphonia*, is also typical of the same formation. As Dr. G. J. Hinde has shown (*Philosophical Transactions*, 1885), certain layers of the greensand are made up entirely of sponge spicules; and it is probable, too, that chalk flints are mainly produced by the same agency.

The subkingdom CELENTERRATA, comprising jelly-fishes, sea-pens, sea-anemones, corals, &c., seems to make its appearance in the form of a few GRAPTOLITES in upper Cambrian rocks, and this subclass is especially characteristic of the Silurian, in the upper beds of which it becomes extinct. *Oldhamia* [see CAMBRIAN PERIOD] is also referred to the class Hydrozoa, but may be simply a mineral structure. The jelly-fishes and sea-anemones are too perishable to have been preserved, except as somewhat indefinite impressions in unusually fine-grained beds, but such have been noted by Dr. A. G. Nathorst even as early as the Cambrian; others occur in the upper oolitic lithographic stone of Bavaria. The CORALS are of very great importance as fossils, from the fact that they constitute so many of the limestones of the earth's crust. In Palæozoic times all these organisms were of the deep-sea type—either solitary or grouped into small aggregations—and rarely formed any extensive masses truly comparable to the reefs of the Mesozoic and later epochs. Reef-like accumulations, however, have been recognized by M. Ed. Dupont in the Devonian and Carboniferous limestones of Belgium, and others have been observed in the calciferous sandstone of Scotland. Professor Albert Gaudry is also

of opinion that there is evidence of gradual progressive development in the minute structure of this group.

The ECHINODERMATA are well represented as fossils. The Echinites (or Crinoidea) make their first appearance in upper Cambrian or lower Silurian strata, attain their greatest development in the lower Carboniferous, and have lived on in diminished numbers to the present time. Certain beds of the Silurian, Carboniferous, and Oolitic limestones are made up almost entirely of their disjointed remains, but these stalked forms are comparatively rare in existing seas, and the only members of the order abundant now-a-days are the free Comatulæ or "feather stars;" it is interesting to note, however, that even the latter are stalked in their young condition. Nearly all the older erinoids are characterized by round stems and a plated roof to the calyx, while the large majority of the Neozoic forms exhibit a five-sided stem, and are destitute of the peculiar roof over the body of the animal; it is also worthy of remark that the free erinoids are not known to appear before Jurassic times. Somewhat allied to the erinoids are the classes of Cystoidea and Blastoidea, exclusively confined to Palæozoic rocks. The brittle-stars (or Ophiuroidea) are first represented by doubtful forms in the lower Silurian, but fossil members of this order are exceedingly rare. The star fishes (Asteroidea) appear to range from a still earlier date, for specimens from the lower Cambrian of Scandinavia have been identified with considerable certainty, and the Silurian limestones afford abundant evidence of the same order at that later period. The sea-urchins (Echinoidea) are likewise an ancient class, and one or two interesting cases of progressive development have been noted among them. All the Mesozoic and Tertiary families are characterized by the ordinary ten double rows of plates in the shell (test), the alternate series being perforate; but in Palæozoic times this class was represented by a peculiar group having more than twenty rows, and in some genera the plates were flexible and overlapping, as in certain rare aberrant forms at the present day. The seventh class of Echinoderms, that of the "sea-cucumbers" (Holothuroidea), has very few fossil representatives, on account of the comparative absence of skeletal structures, but this division can probably be traced back to the Carboniferous system.

The subkingdom Vermes (or worms) is one of especial interest to the biologist, but unfortunately few of its members are provided with sufficiently imperishable structures to be preserved as fossils. Worm-burrows and tracks occur in the lowest Cambrian strata, and throughout most of the later formations of shallow-water origin; the only other traces of this subkingdom consist in the jaws and tubular cases of those forms that happen to possess such parts. Numerous examples of both have been discovered in the upper Silurian rocks, but none of the remains are very satisfactory for classificatory purposes. To this division, also, it is now customary to refer the POLYZOA or "sea-mats," which are abundantly represented in a fossil state. The earliest undoubted fragments hitherto recognized are from lower Silurian deposits, and the Fenestellide are particularly familiar to all collectors of Palæozoic fossils.

Between the Vermes and Mollusca must be placed the geologically important group of BRACHIOPODA. They are the most abundant "shell-fish" of the earlier periods, and are almost extinct at present; sufficient forms, however, still survive to afford some insight into the anatomy of the soft parts of these animals, and it appears that the larval stages are quite worm-like, the bivalved shell being only assumed in the adult.

Of the true MOLLUSCA, the fossil representatives are so numerous in the faunas of the successive formations, that we must refer the reader to the special articles for details. The Pelecypoda (or Lamellibranchiata), to which the

cockles, mussels, oysters, &c., belong, appear to occur first in lower Silurian strata, and have been continually increasing both in numbers and variety, until they have attained their maximum development at the present day; it is also noteworthy that the Palæozoic families belong to the least specialized division of the class. The Gasteropoda and Pteropoda likewise date back to very remote times; in fact, we have seen above that *Theca antiqua* belongs to the earliest known group of fossils, and is probably referable to the last-named division. The Gasteropoda are represented in the upper Cambrian, and the Carboniferous rocks of North America probably furnish the first evidence of air-breathing genera allied to existing land snails. The Cephalopoda (cuttle-fishes, nautili, &c.) constituted a much more prominent feature in the molluscan fauna of past times than they do at the present day; when other carnivorous Mollusca became abundant, their numbers appear to have rapidly diminished, and of the forms bearing true shells the nautilus alone survives. The oldest members of the class are met with in the upper Cambrian (Tremadoc Slates), and it is a noteworthy circumstance, that although the nautilus is at present the sole survivor of the group with four gills, it came into existence at least as early as the period when upper Silurian beds were being deposited. The partitions dividing this shell into a series of chambers unite with the outer shell-wall and produce sutural lines that show no tendency to a wavy arrangement; allied shells of similar age (e.g. *Orthoceras*) also exhibit a like peculiarity. The later Devonian *Clymenia* has sutures slightly wavy, and in the Devonian and Carboniferous Goniatites the lines are sharply bent into a series of zigzags. In the Ceratites of the Trias still greater complexity is observed in the sutures, and among the AMMONITES of Jurassic and Cretaceous times the sutural markings are so wavy and crimped that below the outermost layer of the shell there is a most exquisite pattern simulating leaves. There is thus decided evidence of progressive development among the tetrabranchiate Cephalopoda, and it is interesting to observe how the least specialized of all—the archaic nautilus itself—has alone succeeded in the struggle for existence. Of the two-gilled (dibranchiate) section of the class, the living squids, cuttle-fishes, and argonauts are typical examples. They are chiefly represented as fossils by the BELEMNITES, but in the Tertiary period these became extinct, and were entirely replaced by existing types; some of the latter, indeed, range back to the later Mesozoic strata.

The subkingdom ARTHROPODA is first represented in remote Cambrian times, and affords several interesting cases of evolutionary change. It includes the classes of CRUSTACEA (crabs, lobsters, &c.), ARACHNIDA (spiders, scorpions, &c.), MYRIAPODA (centipedes), and INSECTA (insects). Of these, the first-named are most abundant and well preserved in the fossil state, from the fact that they are aquatic animals, and possess a thick limy covering. The TRILONITES, belonging to this class, are its earliest representatives, and range from the lower Cambrian to the lower Carboniferous inclusive; some of the oldest are very lowly forms, though advanced types appeared even before the deposition of the lower Silurian. Another Palæozoic group of Crustacea was that of the Eurypterida, including some gigantic and some small species, and ranging from upper Silurian to lower Carboniferous formations. The "seraphims" of the Scotch Old Red Sandstone are typical examples, and belong to the genera *Pterygotus* and *Eurypterus*. The Ostracoda and PHYLLOPODA are also Palæozoic, though several have survived through later periods until the present time, and Crustacea resembling the living king crabs appear first in the upper Silurian, but do not become abundant until the higher Carboniferous deposits are reached. No remains of the most specialized group of the Crustacea—that in which stalked eyes are a

constant feature—have hitherto been discovered in rocks before the Carboniferous, and this division has been continually becoming more numerous, until it has attained its maximum development at the present day. The Trilobites and Eurypterida bear an interesting resemblance to the larval forms of some of the more advanced groups, and the king-crabs, which are closely allied to, but more highly organized than, the Eurypterida, singularly begin to prevail as the latter diminish in importance. Remembering also that the still higher types are almost exclusively Mesozoic and Cainozoic, it would appear that progressive development is most plainly indicated. All that is known of the Arachnoiden points to a similar conclusion in regard to this class. The scorpions of the Carboniferous age are practically of the same type as those still living, but two examples have been discovered in the upper Silurian of Sweden and Scotland, which are much less specialized and more larval in character. (See *Nature*, 29th January, 1885.) Spiders are known from the Coal Measures and later rocks, and many interesting specimens are preserved in the Tertiary lumps of amber (fossil resin). The Myriapoda or centipedes date back to still more remote times, Mr. B. N. Peach having recorded fossil forms from the lower Old Red Sandstone of Forfarshire; and many satisfactory remains have also been discovered in the Coal Measures. According to our present information, the insects are of particular interest as being the oldest known air-breathers, for the wing of a cockroach was discovered some time ago in the middle Silurian beds of Calvados, France. (See *Proceed. Geologists' Association*, August, 1885, p. 143.) Others are recorded from the Devonian rocks of New Brunswick, but the perishable nature of the members of this class renders them extremely rare in the fossil state. The Coal Measures yield a few forms, and also later fine-grained beds, but of Tertiary insects the most complete information is obtained from specimens preserved in amber.

But of all the subkingdoms in the animal world none can vie with the highest—that of the VERTEBRATA, or back-boned race—in the interest and importance of its palæontological history to the biologist. So far as is yet known, none of the vertebrates had become sufficiently advanced in type to possess hard skeletal structures capable of fossilization before the time when the upper Silurian beds were deposited. It would therefore be possible, if the geological record were complete even from the Silurian period, to discover the main facts regarding the manner in which the present diversity of the subkingdom has been brought about. Unfortunately, however, our information is at best fragmentary, and only a few glimpses have hitherto been obtained of the secular changes in some of the more advanced types.

The earliest known fossils probably referable to this subkingdom are certain little tooth-like bodies, discovered in the lower Silurian rocks of Russia and North America, and also met with in later Palæozoic formations in the same countries; these are termed *condonts*, and bear a remarkable resemblance to the teeth of lowly fishes, such as the lampreys. In the lower Ludlow rocks, an undoubted fish-shield (*Scaphaspis ludensis*) has been found; the upper Ludlow bone-bed has yielded other shields, and the spines of shark-like fishes (*Onchus*); and the passage beds to the Old Red Sandstone begin to afford still more satisfactory evidence of the same class. In the OLD RED SANDSTONE fishes suddenly attain to an extensive development, and an account of these has already been given in the special article. They all belong to the orders in which there is little tendency towards elaborate skeletons, and in which almost all the hard parts occur as outside shields and scales. In the Carboniferous strata bony-plated fishes and sharks (with some intermediate forms) still constitute the prevailing type, and Jurassic times were passing away before there was any very well-marked approach towards

the chiefly soft-scaled fishes, with complex skeletons (Teleostei), which predominate at the present day. No undoubted teleostean is known to occur below the Cretaceous system. It would therefore appear that as ages have rolled on one after another, there is distinct proof that the fishes have become more and more specialized, and that the out-of-date types have constantly diminished in number as the new races have entered upon their domains. The lampreys, sharks, ganoids, and mud-fishes—all early forms—are considerably more generalized than the teleosteans that constitute the prevailing type at present; and one feature in connection with the tail is particularly worthy of note. The oldest fishes had tails either straight and pointed (diphycecal), or pointed and turned upwards (heterocecal), whereas it has now become fashionable to possess a fan-like caudal appendage, quite symmetrical so far as external appearance is concerned. Now, when the embryonic stages of one of these modern fishes are examined, the tail is found to be first straight, then slightly upturned, and lastly so modified as to give the false symmetry of the adult; here, therefore, there is an interesting example of the history of the individual recapitulating the history of the race.

No fossil AMPHIBIA have hitherto been discovered in rocks earlier than the Carboniferous, but they occur in such profusion on this horizon, and constitute so important a feature, that we are justified in regarding their first appearance as having been much more remote. In the swamps of the coal period a number of crocodile-shaped forms—some a few inches, and some a few yards in length—were widely spread over the earth's surface, and constitute a distinct order of the class termed LABYRINTHODONTA or Stegocephali. They received the first name from Sir Richard Owen, from the complex structure of the teeth in many genera; and the second name was given by Professor E. D. Cope, in allusion to the roofing-in (by bony plates) of the fossa on each side of the skull where the muscles for raising the mandible are situated. Many beautiful fossils of this order have been found in the Northumberland, Scotch, and Irish coalfields. *Archegosaurus* is met with in the Permian of Germany, and other genera in North America. Bones of other labyrinthodonts occur in the Trias of Warwickshire and the Continent, and the well-known footprints of *Cheirotherium*, found in the Triassic sandstones of Cheshire and elsewhere, were probably made by the same animals. The order seems to have finally disappeared in early Jurassic times, and if it has left any descendants whatever these are merely the rare serpent-like *Cæciliæ* of the present day. Of the existing tailed amphibians—newts and salamanders—the palæontological history is very imperfect. No undoubted remains are known of more remote date than the skeleton of *Hylæobatrachus Croyii*, discovered some years ago in the Wealden of Bernissart, Belgium; nor are such fossils abundant in Tertiary deposits. A large salamander (*Andrias Scheuchzeri*) from the Miocene of Eningen, Switzerland, was described by Scheuchzer in 1726 as *Homo diluvii testis*—"a man who witnessed the deluge." The tailless Amphibia—frogs and toads—are a highly specialized group that can hardly be expected to have representatives in old formations: the earliest have been detected in beds of Miocene age, and some are slightly less removed from the general amphibian type than those of the present fauna.

Of the class REPTILIA undoubted remains are first discovered in the Permian deposits of Germany, Russia, England, and North America; but the forms represented both in the Permian and Trias are of so peculiar and generalized a character, that it is almost impossible to refer many of them to their correct place in classification. Indeed, it would seem that several of the great orders of later times have only become well differentiated since those remote periods, and it is possible that, as research progresses,

much light will be thrown upon their evolutionary history. The crocodilian order is perhaps the most completely elucidated in the present state of knowledge, and that of the Chelonian the least understood.

Taking the various reptilian groups in succession, we begin with the Chelonian. Small fragments of the carapace of *Chelytherium obscurum* have been found in the upper Trias of Stuttgart, and the animal was decidedly a well-marked member of this order. Other fragmentary Chelonian remains occur in the Lias, and the later Jurassic rocks have yielded numerous very perfect fossils. Those of the Bavarian lithographic stone (Kimmeridgian) are especially fine; the English Kimmeridge clay has afforded a few satisfactory specimens; a turtle (*Chelone planiceps*) has been discovered in the Portland stone; and the Purbeck beds contain abundant traces of marsh tortoises (*Pleurosternum oratum* and other species). The Wealden and Cretaceous beds are also characterized by several species, and the small turtle (*Chelone bensteadii*) from the English chalk, and the large one (*Chelone hoffmanni*) from the upper strata of Maastricht, Holland, are especially well preserved. Among Tertiary formations the London clay of Sheppy has yielded a large number of turtles and a few marsh tortoises; and several fine carapaces of mud tortoises (*Trionyx*) are known from the higher beds of Hordwell, Hampshire. Other remains occur in the later Tertiaries, and one species survived in British areas even as late as the time when the forest bed of Norfolk was formed. [See FORNERS, FOSSIL.] Reviewing their past history as already known, all that can be said of the Chelonian is, that they have not changed in type since the Triassic period, and have only undergone differentiation into subordinal groups: in early times, for example, the turtles were not so distinct from the Emydians (marsh tortoises) as now.

An order that existed only for a short period at the beginning of the Mesozoic era is that of the Anomodontia—so called from the anomalous dentition prevailing throughout the group. It consisted of reptiles (1) having the dentition confined to two great tusks in the upper jaw (Dicynodonts); or (2) having the teeth almost as well marked out into molars, canines, and incisors as in mammals (Cynodonts); or (3) being destitute of teeth, except perhaps a few minute canines (Cryptodonts). They were also characterized by a sacrum of more than two vertebrae and other interesting features. Dicynodon occurs in the Trias of South Africa, India, and Russia, and the discovery of a skull in the yellow sandstones near Elgin was announced at Aberdeen in 1885. (See *British Association Reports*, 1885.) Of greater interest, perhaps, is the order of Rhynchocephalia, but its limits have not yet been very clearly defined. Its sole representative at the present day is the little Tuatara Lizard (*Hatteria punctata* or *Sphenodon punctatus*), found in certain parts of New Zealand, but among Triassic and later fossils many members are known. Rhynchocephalus and Hyperodapedon occur in the British Trias, and others are known both from Europe, South Africa, and North America. It evidently forms a generalized group now out of date. The orders Plesiosauria and Ichthyosauria are referred to in special articles, but the fossil members of the Crocodilia demand a brief notice. This order is more completely known than any of the others. It was first foreshadowed by *Helodon* and *Stagonolepis* in Triassic times, the former being found in Württemberg, India, and North America, and the latter in the sandstones of Elgin, N.B. Teleosaurus and its allies were marine crocodiles of the Jurassic period; the Wealden and Purbeck beds afford evidence of broad-faced marsh-dwelling forms; and the early Tertiaries yield remains of existing genera, but these have a different geographical distribution to their descendants of the present day. Being one of the most specialized groups of reptiles, the possibility of determining its past history is thus of unusual interest and importance. Among

other features in the series of changes that have resulted in the existing type, we may particularly note, (1) the comparatively early removal of the external nostril to the end of the snout; (2) the gradual growth of the palate bones into plates, causing the posterior opening of the nasal chamber upon the roof of the mouth to recede further back until it attained the remote situation it has at present; (3) the very slow alteration in contour of the hollows in the sides of the skull, where the muscles for raising the mandible are situated, to provide for as gradual an alteration of those muscles; (4) the passage of biconcave into flat-ended and eventually concavo-convex vertebrae; and (5) the modification of the earlier types of dermal armour into that of the living crocodiles. (See paper by A. Smith Woodward in *Proceed. Geologists' Assoc.*, 1886.) The DINOSAURIA are closely related to the crocodiles, and the Permian *Protosaurus spenceri* is probably their earliest known representative. They exhibit some signs of progressive development, but the results of researches upon the vast materials collected in North America by Professor O. C. Marsh and others must be awaited before any definite conclusions can be arrived at. The palaeontological history of the Lacertilia (or LIZARD) is not yet very well known, and all the change that can be definitely observed in them is a passage from biconcave or flat-ended vertebrae to the concavo-convex vertebrae now characterizing the majority. No Ophidia (or SNAKES) have been found in strata more remote than the Cretaceous, and all satisfactory information regarding even the later forms is at present wanting. Palaeophis is found in the Eocene of England, and must have been a serpent of considerable size. Lastly, there are the Pterosauria (or PTERODACTYLES)—an order of flying reptiles that suddenly appears in the lower Lias and as suddenly disappears in the upper chalk; nothing is known of their origin, for the Liasic Dimorphodon is perfectly differentiated, and the only change that the order appears to undergo in time is an increase in the size of the individual genera, a loss of teeth in some forms, and certain specializations in the skeleton to provide for the exigencies of wielding huge organs of flight. The Jurassic Pterodactyles are best represented on the Continent and in England, and those of the Cretaceous in North America.

Passing on to birds, we are led to expect interesting information concerning their rise and development from palaeontology, for the class, as represented at the present day, is so homogeneous and so difficult of subdivision into any well-defined minor groups, that its comparatively recent origin can almost be regarded as certain. Unfortunately, however, bird remains are extremely rare in a fossil state; indeed, when we remember their mode of life, we can appreciate the uncommon nature of the accident by which the bones of any but water-birds will become entombed in sediment at all. But the scanty knowledge of fossil birds already obtained is very satisfactory as far as it goes, and there need be little hesitation in stating that they have developed from the reptilian stock at a comparatively late period of the earth's history. The earliest known fossil of this class is *Archæopteryx*, from the lithographic stone (Upper Oolite) of Bavaria; it is a bird having many reptilian affinities in its skeleton, but clothed with true feathers; three fingers bear claws, the tail is long and lizard-like, the vertebrae biconcave, and the jaws are armed with teeth. In the latter character it agrees also with the Cretaceous birds *Hesperornis* and *Ichthyornis*, discovered by Professor Marsh in America; and it seems probable that, at least until Eocene times, the ancestors of the now beaked class all possessed true teeth. *Argillornis*, from the London clay of Sheppy, was probably toothed, and *Odontopteryx*, from the same bed, had bony denticles. From what branch of the reptilian class the feathered tribe arose is not yet definitely determined, but everything seems to point to the DINOSAURIA. Professor Marsh states that the separate

bones of the small dinosaurs found in the Jurassic of America are undistinguishable from those of ancient birds if the skull is wanting, "and even in this part the resemblance is striking. Some of these diminutive dinosaurs were perhaps arboreal in habit, and the difference between them and the birds that lived with them may have been at first mainly one of feathers."

The earliest fossil of importance hitherto referred to the great class of MAMMALIA is the anterior portion of a skull obtained from the upper Triassic (or lowermost Jurassic?) strata of South Africa. It was described by Sir Richard Owen, in 1884, under the name of *Tritylodon longavus*, and is of especial interest from the fact that it is far from being of a generalized type. The skull may possibly belong to the MONOTREMATA or the MARSUPIALIA, but its characters point to the existence of a long ancestral series yet to be revealed. Detached mammalian teeth of Triassic and Rhaetic age are also found in England and on the Continent, and referred to species of *Microlestes*; while lower jaws of *Dromatherium sylvestre* have been described from equivalent strata in North Carolina. Of the mammals of the Jurassic period only two beds in Britain have hitherto yielded any evidence. The Lower Oolitic Stonesfield slate of Oxfordshire is characterized by at least three genera, and a thin stratum in the Middle Purbecks of Durdlestone Bay, Swanage, is still more prolific. The known forms from Stonesfield comprise lower jaws of *Amphitherium*, *Phascolotherium*, and *Sterognathus*, all provided with teeth, and the two former having a marsupial facies; two limb bones are also described, but cannot be referred with certainty to either of these genera. The Purbeck mammals are known not only by lower jaws, but also by fragments of skulls and a few limb-bones; and they appear to belong to several generic types. [See PURBECK BONES.] All other Mesozoic deposits are as yet silent in regard to the mammalian fauna of that epoch, except possibly the Cambridge greensand, which is considered to have yielded some whale-vertebræ; but much may be expected from still unpublished discoveries in America. And to whatever group the Stonesfield and Purbeck fossils are eventually referred, they obviously belong to the lower orders of the class, and are perhaps representatives of the lowly monotremes, and bear witness to the time when that now toothless group had a fully developed dentition. From the dawn of the Tertiary age the palæontological history of the Mammalia is much more complete and satisfactory, and it is possible, from materials already discovered, to trace the rise and development of many great orders observed to-day. In fact several of the existing groups appear to have been almost entirely differentiated during this latest of geological periods, and by combining the fossil evidence both of the Old World and the New, a most interesting mass of information has already been obtained.

Briefly alluding to the various sections in order, we commence with the subclasses of Prototheria (monotremes) and Metatheria (marsupials), which are the lowest, and which have already been mentioned as probably comprising the small Mesozoic Mammalia; among Tertiary strata the former subclass is only represented in the comparatively recent cave-deposits of New South Wales, but remains of the latter are widely spread. Fossil opossums are found in the Eocenes of England and the Continent. Of the higher subclass, Eutheria, the first order of sloths, anteaters, and armadillos (*Edentata*) has probably a few representatives in the middle Tertiaries of France and Greece, though now confined to Central and South America and portions of Africa; the most abundant remains, however, occur in the recent deposits of South America. [See GLYPHODON and MEGATHERIUM.] The ancestral history of the curious SIRENIA, or sea-cows, can be traced to some extent, the hind limbs not being altogether absent in the earliest forms, and the dentition being

more generalized. *Prorastomus* is an old fossil from Jamaica, *Eotherium* from Egypt, and *Haltitherium* a Miocene fossil on the Continent, occurring also in the red crag of England. Nothing much is yet known of fossil whales (*CETACEA*), but the Eocene *Zeuglodon* departs much less from ordinary Mammalia than the members of this order now living. The order INSECTIVORA, of which moles, shrews, and hedgehogs are at present typical forms, appears to have been scarcely separated from the Carnivora and Lemnina in the Eocene period, and has become slowly marked off during the succeeding ages. BATS (or Chiroptera) have been discovered typically developed in the lowest Tertiaries of France, so that they are probably an ancient tribe. The RODENTIA (or gnawing animals) also seem to be of early origin, but certain American fossils are intermediate between these and the UNGULATA. Of the last-named order, comprising the hoofed animals, the geological record yields innumerable extinct forms, which afford an insight into the gradual differentiation of many of the suborders and families that appear now quite isolated and distinct. The elephants began to be distinguished in the Miocene period, and it is interesting to trace the gradual development of the special characters at present peculiar to the group. As regards the front teeth, it may be noted that some of the Miocene mastodons had tusks both in the upper and lower jaws, which were opposed to one another like the front teeth of beavers or squirrels; later species had the upper and lower tusks not touching each other; others lost the lower teeth; and in later true elephants, like the MAMMOT, the remaining upper tusks were much curved. The grinding teeth are remarkable from the fact that they consist of a number of sharp folds with the hollows filled with soft cement; the Miocene *Dinotherium* shows the first approach towards this type, but possesses no cement; the Pliocene *Stegodon* have the grinders still more folded, with a little cement between the ridges; and among the true elephants every stage from this to the most complex can be recognized. The abnormal mode of succession of these teeth also disappears as we trace back the extinct forms. The great height of the living elephant compared with its length is also remarkable, but the earliest known mastodons had bodies much more elongated. We have thus considerable information already concerning the progenitors of the singular tribe of elephants. Still more is known concerning the evolution of the odd-toed hoofed animals proper (*Perissodactyla*). In early Eocene times they were very much mixed, but these animals have since diverged into three well-marked types represented in the living fauna. These are the tapirs, the rhinoceroses, and the horses, and the first-named have undergone least modification. In fact, tapirs are known to occur in Miocene deposits, and they have probably retained their ancient character in consequence of their persistent habit of dwelling in marshy lands, for which their structure is admirably adapted. The history of the rhinoceroses can also be determined to some extent, especially the appearance of the horn (which was at first absent) and certain prominent features in the dentition, but that of the horses is much more eventful. It appears that in Eocene times the ancestors of the latter group were five-toed animals allied to the tapirs, and likewise living in marshes; gradually they deserted their primitive swamps and forests, and began to inhabit grassy plains, when changes of structure requisite for the new conditions as slowly made their appearance. A broad spreading foot was no longer necessary for tramping over the mud, and in successive generations the toes became reduced one by one until the modern horses have become admirably adapted for swift progression by retaining only a single toe with a largely developed nail (or hoof). Long grasses and thick scrub no longer protected the animals from their enemies without exertion,

and the neck thus became elongated and the head adapted for espying approaching foes. And, lastly, their daily food no longer consisted of soft stems and succulent leaves, but rather of dry grasses and other hard herbage, and their teeth became accordingly modified to suit the new circumstances; not only was the grinding surface of each tooth made more complex by infoldings of enamel, but it was also elongated very much to compensate for the greater wear, so that the creature might be provided with dentition even to old age. Fossil skeletons, or portions of fossil skeletons, of all the stages in this interesting series have been discovered both in Europe and America; but it is in the latter country that the most abundant and perfect remains are known. The even-toed hoofed animals (Artiodactyla) have branched into two great groups with many minor subdivisions—the one very little modified and comprising the pigs, peccaries, and hippopotami; the other, the camels, chevrotains, oxen, and deer. The earliest known members of this suborder had tuberculated teeth, and the first of the two groups just mentioned may be regarded as directly derived from these ancient forms with very slight alteration; in fact, like the odd-toed tapirs, they have confined themselves to their old marshy haunts, and have had little inducement to alter their structure. But the second group, like the horses, wandered from their original home and underwent somewhat similar changes, except that from some fundamental cause not yet discovered the feet were so employed that two symmetrically placed toes remained instead of one; and when a single toe bone became advantageous (as in the deer, oxen, &c.) the two were fused together, except the hoofs, which remained to form a cloven foot. Tuberculated teeth were of no use in the new haunts with hard herbage, so that four or more of the tubercles slowly became compressed to form sharp ridges, and in time there resulted the admirable grinders now to be observed; moreover, as in the horses, the teeth have become elongated to compensate for the greater wear. With the exception of the little chevrotains, which are the survivors of one of the out-of-date tribes, and still live on the borders of rivers in the Malay Peninsula, Ceylon, and Africa, all these animals have also acquired digestive organs so arranged that they chew the cud. This peculiarity enables them to procure food rapidly on exposed grassy plains, and then masticate it at leisure under the shelter of the forest; it is of advantage to them in escaping the more easily their carnivorous foes. Another acquired peculiarity in two great families is also interesting. None of the early cud-chewing (ruminant) animals possessed horns; but the deer on the one hand, and the oxen and antelopes on the other, are both particularly characterized by such structures at the present time, though they are sometimes absent, and especially in the females. The first-named family possesses these appendages in the form of antlers, more or less branched, which are shed annually. Until one year old, the deer possesses no antlers whatever, then an unbranched prong appears, the next year it has two branches, then three, and so on until the maximum complexity is reached. And it is interesting to note that this development is precisely paralleled among the race of fossil deer; the middle Miocene forms had two-pronged antlers; in the Pliocene forms they were a little more complex; and it is only quite lately, geologically speaking, that the antlers have assumed the great complexity to be observed in some species at the present day. The oxen and antelopes have true horns—processes of bone inclosed in a sheath—and just as these are only acquired by the individual now as it attains maturity, so the geological record teaches that their acquirement by the race has only been gradual, and that in the middle Tertiaries such appendages are unknown.

The families of CARNIVORA, or flesh-eating animals, have also been mostly differentiated during the Tertiary

period, and many of the Eocene and Miocene members of the order are extremely generalized in character. One of the cats, *Eusmilus*, is a remarkable form from the Eocene, and shows that that branch of the Carnivora must be of very ancient origin; in other cats, however, it is possible to trace back the ancestors, until the short jaws and restricted dentition of the present day pass into the more general type from which all divisions are sprung. Professor Albert Gaudry has also pointed out some primitive links in the chain uniting the specialized hyænas with the less differentiated genera of early times; and among the Carnivora of the upper Eocene and lower Miocene periods it is almost impossible to distinguish such families as those of the civets, dogs, and bears one from the other. The oldest Tertiaries also yield remains of a number of Carnivora that possess four molar teeth, like the marsupials, and until the mode of succession of the teeth had been discovered, they were always placed in that inferior subclass. Hyænodon and Pterodon are two well-known genera of this group. But there still remains one great desideratum, when studying the carnivorous order; nothing is yet known regarding the origin and history of the seals. A suborder so highly specialized and so different from the majority of mammals, may be expected to have a most interesting genealogy, but this has still to be revealed. The seals are probably descended from terrestrial Carnivora allied to the ancestors of the bears.

Of the highest order of Mammalia—that of the Primates, including man himself—no large series of remains has hitherto been discovered. If the lemurs are correctly placed here, however, it may be safely said that this division has become differentiated from the primitive Insectivora and Ungulata since the early Eocene period. As regards the monkeys and man, the fossil evidence is much too incomplete for any definite conclusions. The middle Miocene of Sansan in France has yielded the earliest known monkey remains, and the Pliocenes of that country and Greece have also afforded others. (See H. A. Nicholson, "Palæontology," two vols., 1879; R. Owen, "Palæontology," 1861; A. Gaudry, "Les Enclauvements du Monde Animal; Mammifères Tertiaires et Fossiles Primaires," 1878 and 1883; W. K. Parker, "Mammalian Descent," 1881; W. Boyd Dawkins, "Early Man in Britain," 1880; and the writings of Huxley, Flower, Marsh, and Cope, in various scientific journals.)

The past history of plants is much less perfectly known than that of animals, and all that can as yet be definitely stated in regard to this kingdom is, that progressive development is conspicuous in a general way. The earliest fossil plants belong to the lower groups, and the most specialized are only found in the latest deposits; but a general outline of the succession has already been given in the palæontological section of the article *Geology*. (See Saporta and Marion's "L'Évolution du Règne Végétale," 1881-85; Williamson's *Memoirs in the Royal Society's Transactions*.)

Reviewing the history of life upon the globe as a whole, it is obvious that each great epoch has been characterized by its own "dominant type" of organism, both in the animal and the vegetable world. Until later Silurian times the highest functions of the living community appear to have been performed by invertebrate animals. On the appearance of Fishes this class speedily gained the ascendancy, and attained to a stage of development such as it has since only feebly enjoyed; for, although it is true that the bony fishes of the present day are by far the most specialized, the fish fauna of the Old Red Sandstone was considerably in advance as regards general structural arrangements. In the Carboniferous, Permian, and Triassic periods, the Amphibia assumed this leading "aristocratic" position, and though, in this class also, there are many existing forms considerably more specialized, yet none can

be compared in functional importance with the huge labyrinthodonts of those remote times. Then followed the Jurassic and Cretaceous epochs, with such a profusion and development of saurian life that they have been well termed the "age of reptiles;" and lastly, this great class began to diminish in importance as Tertiary times drew near, and the Mammalia and Birds became the dominant groups, as they have continued to be ever since. Each division of the animal world has thus had its palmy days at one time or another, and the particular period has depended upon the status of the group, the lowest always preceding the highest.

In the vegetable kingdom at least three main periods can also be recognized. The Palæozoic was pre-eminently the age of cryptogams; in the Mesozoic the gymnospermous plantæ are the dominant type; and in the Cainozoic or Tertiary, the angiospermous plantæ occupy the leading position.

On looking back upon the history of life it is also interesting to observe how some forms are much more successful in the struggle for existence than others. And it is a general law, that the lower the organism the greater is its range in time. Some of the genera of Foraminifera have an enormous range. It is also to be noted that the least complex members of any particular group are likewise the most long-lived. As already remarked, for example, the unpretending nautilus is found in upper Silurian rocks, and has survived to the present day, whereas all its more specialized "cousins" and descendants have only occupied short spans of geological time. The persistence of the brachiopods *Lingula* and *Dicelina*, with very slight change, from the earliest Cambrian age to existing seas, is also noteworthy when we reflect on the hosts of members of that group that only range through comparatively restricted periods; and many other instances might be mentioned.

But, as remarked at the outset, palæontology not only endeavours to elucidate the developmental history of the various types and groups of living beings, but also affords important information regarding the manner in which they have come to be distributed over the earth's surface as observed to-day. The geographical distribution of plants and animals is practically inexplicable, except on the consideration of facts provided by fossils. Why, for example, does a mud-fish (*Lepidosiren*) occur in Brazil, one other (*Protopterus*) in Western Africa, and one other (*Ceratodus*) in Queensland, while not a trace of another occurs anywhere in the world? Palæontology teaches that these are merely the surviving outliers of a great race that, at one time or another, has occupied every portion of the globe. Again, it is a remarkable fact that (with the exception of the opossums of South America) the marsupials are exclusively confined to the Australian region; so likewise are the still more lowly mammals, the monotremes. But when we reflect that there was once a time in which this was the highest stage the Mammalia had reached—and when we remember, also, that fossil marsupials are found both in Europe and America, and perhaps Africa too—the conclusion is not unnaturally arrived at, that the present land of Australia preserves an assemblage of creatures now out of date. From the fact that primitive shells, an old shark, the mud fish, and early types of vegetation are also associated with these marsupials, it may be inferred that that region of the globe has been isolated from other great continental areas since very remote—probably Mesozoic—times. Palæontology also throws light upon the relations of the faunas and floras of the Old World to those of the New, and affords a reason for many peculiarities that are in themselves quite incomprehensible. Space, however, prevents the introduction of further illustrations, and reference may be made to special works. (See especially A. R. Wallace "On the Geographical Distribution of Animals" and "Island Life.")

PALÆOTHERIUM is a fossil genus of ungulate mammals, most nearly allied to the Tapiridae and Equidae. *Palæotherium* is found in various Eocene beds in Europe. In the character of its skull *Palæotherium* resembled the living tapir, and probably, like that animal, possessed a short proboscis. It had three toes on each foot. The dentition is that which is regarded typical for a mammal, forty-four teeth arranged thus:—

$$\begin{array}{l} I. \ 3-3 \qquad 1-1 \qquad pm. \ 4-4 \qquad m. \ 3-3 \\ \qquad \qquad \qquad 1-1 \qquad \qquad 4-4 \qquad \qquad 3-3 \end{array} = 44.$$

From the remains found in the gypsum quarries of Montmartre, near Paris, Cuvier attempted a restoration of *Palæotherium magnum*, considering that in general form it closely resembled the living tapir of South America. Subsequent discoveries have shown that *Palæotherium* must have presented more resemblance to a llama, possessing a long neck. It is probable that *Palæotherium* frequented the borders of lakes and large rivers, feeding upon the leaves and twigs of brushwood.

PALÆOZOIC ERA (Gr. *palaio*s, ancient, *zôê*, life) is the earliest of the three main divisions of geological time, and comprises the Permian and all underlying formations. This great epoch is also sometimes termed the Primary, and the series of deposits that represent it are incomparably thicker than those formed during the succeeding Mesozoic and Cainozoic periods taken together. Detailed particulars, however, are given in *Geology*. Among the most notable features of the era were the early predominance of the Invertebrata, and the incoming of vertebrate animals (fishes) in the upper Silurian. Fishes were the dominant type in the Old Red Sandstone period; the amphibian lalyinthodonts become important in the Carboniferous; and true reptiles seem to make their first appearance in the Permian. Among plants, it was the age of cryptogams, which culminated in the Carboniferous. See also **NEOZOIC** and **PALÆONTOLOGY**.

PALAIIS-ROYAL. See **PARIS**.

PALAIIS'TRA (Lat. *palaestra*), which properly means a school for wrestling, was used in several different significations. The word first occurs in Herodotus, who informs us that Kleisthenês built a *dromô*s and *palaistra*, both of which he calls by the general name of *gymnasia*. At Athens, however, it appears probable that the *palaistra* and *gymnasia* were distinct places, and that the former were private establishments for gymnastic exercises of the boys and men, especially of the professional athletes, their chief studies being the *pankration* and wrestling; while the latter were public buildings for general athletic purposes, naturally frequented chiefly by men only.

PALAMEDES, in the Greek mythology, was the grandson of Atreus by his mother's side; his mother was a sister of the mother of Agamemnon and Menelaos. He accompanied his cousins to the war of Troy, but both they and others were jealous of the fame his bravery and his skill in many useful arts and in poetry quickly acquired him. Odusseus (Lat. *Ulysses*) was among the envious chiefs, and undertook the hateful task of making away with him. The tale thus becomes one of the typical examples in antiquity of the treacherous betrayal of an innocent person. Odusseus caused a forged letter to be written by a Trojan prisoner to Palamedês, coming apparently from Priam, king of Troy, and this letter was concealed under his couch. Then the chiefs, coming with a great company and declaring their suspicions of the conduct of Palamedês, proceeded to search his tent, and when they found the letter hailed it as a proof of treasonable correspondence, and condemned the innocent hero to be stoned to death. The legendary speech with which he met his fate was always thus given—"Truth, I lament thee, for thou hast died before me." The fate of Palamedês was a stock subject of debate in ancient Greece, the tale being of great

antiquity and probably found in the "Cypria," though not in Homer.

PALANQUIN' or **PALKEE**, a species of chair made use of in the East as a vehicle of conveyance, and consisting of a wooden box about 8 feet long, 4 feet wide, and 4 feet high, provided with wooden blinds, which open or shut at pleasure, and admit a supply of fresh air while excluding heat or rain. It is furnished in the interior with cushions or a mattress, a shelf, drawer, and other conveniences. To each palanquin there are four *hammals*, or bearers, two at each end, who carry the vehicle by means of stout poles, like a sedan chair. The bearers are relieved at intervals, and a long journey is thus accomplished with astonishing ease and celerity.

PAL'ATALS. The sounds *ch* and *j* or *dy* (respectively shown in *church*, *judge*) are so called because chiefly articulated by means of the palate.

PAL'ATE (Lat. *palatum*) is the partition which separates the cavity of the mouth from that of the nose, forming the roof of the one and the floor of the other. In man it is composed of two portions, which are called respectively the hard and the soft palate; the former is made up of the inferior or palatine processes of each superior maxillary bone and palatal bone, which, meeting in the middle line of the body, form a somewhat flattened arch over the mouth; the latter consists of a membranous curtain of muscular and cellular tissue, of which one margin is attached to the posterior border of the hard palate, and the other, with the uvula appended to its middle, hangs loosely backwards into the cavity of the pharynx.

The hard palate serves as a firm support against which the food may be pressed by the back of the tongue during mastication. The soft palate is capable of such motions by the contractions of its muscles, that it can either be raised so as to close the passage from the pharynx to the nose and Eustachian tube, or be depressed so as (with the assistance of the tongue) to close the passage from the pharynx to the mouth, or even to close both these apertures.

PALAT'INATE, THE (*Pfalz* in German). There were formerly two states in Germany of this name, which, till 1620, were under one sovereign; they were not contiguous, and were called, by way of distinction, the Upper Palatinate and the Lower Palatinate. The Lower Palatinate was called likewise the County Palatine of the Rhine, or the Palatinate of the Rhine.

The Upper Palatinate, originally an imperial duchy, was bounded by Baireuth, Bohemia, Neuburg, Bavaria, and the territory of Nürnberg. The area was 2730 square miles. Amberg was the chief town. The Upper Palatinate is now wholly Bavarian.

The Lower Palatinate was situated on both sides of the Rhine, and was bounded by Katzenellenbogen, Würtemberg, Baden, Alsace, Lorraine, and Treves. The chief cities were Mannheim and Heidelberg. The Lower Palatinate was shared in 1815 by Bavaria, Hesse-Darmstadt, and Prussia. It furnished an elector to the empire, and its original area was about 3100 square miles.

The *Pfalzgraf* or *Palsgrave* was of much higher dignity than the mere *graf* or count. He was, as his name implies, originally a high dignitary of the imperial *palace*, a count palatine, or *PALATIN*, and his special function was to preside over the Frankish royal court of justice. In rank he came next to the mayor of the palace, a dignity which merged, in the person of Pippin the Short, into that of King of the Franks.

Otto I., emperor of Germany, conferred upon the Palsgrave Hermann, in 966, the important duty of guarding the westward frontier, and therefore, as swift decision was often necessary, almost imperial authority was placed in his hands. It is almost needless to say that the result of this was that very soon the palsgraves achieved practical independence. The first Count Hermann was succeeded

by his son, and the dignity was deemed hereditary. His grandson, the third count, Conrad, was created Duke of Swabia by the Emperor Henry III. in 1015, and, with his brother who succeeded him, the first line ceased. The dignity passed through several hands, and was eventually conferred on another Conrad of Swabia by the Emperor Frederick I. (Barbarossa) in 1136, the new Count Palatine accompanying his master in his conquests in Italy. Henry of Saxony, the son of the famous opponent of Barbarossa, Henry the Lion, and son-in-law of Conrad, succeeded him in 1196. He accompanied the Duke of Brabant to the Crusades in 1197. In the troublous times of the young Frederick II.'s early reign Count Henry took the wrong side, and was condemned and outlawed at the Diet of Ratisbon, 1214; but he was reconciled to the emperor in the next year, and became a faithful servant. He yielded his right to imperial ornaments in 1219, and was named vicar of the empire in Saxony. The next count, one of the Wittelsbach family (Otto II.), who inherited the Palatinate by marriage, was a son of the Duke of Bavaria, and indeed eventually succeeded to the duchy; and therefore, great as was his influence, he was not permitted to take part in the election of an emperor, Bavaria already having a vote. Otto was offered the imperial crown by Gregory IX. in 1228, but declined it. His son, Ludwig the Severe, duke of Bavaria, and Count Palatine of the Rhine, succeeded in 1253. It was he who acquired the duchy of the Upper Palatinate in 1267. He thus became a very powerful prince, and was chosen by the electors to terminate the interregnum which occurred on the death of Conrad IV., at the time when our own Richard, earl of Cornwall, brother of Henry III. of England, was a candidate for the imperial crown. All the candidates bribed, intrigued, and threatened shamelessly, and great confusion resulted. Ludwig named Rudolf of Hapsburg emperor in 1273—a very wise choice, for peace and order soon returned to distracted Germany. Thus the great fortunes of the house of Hapsburg were laid. In gratitude the emperor gave Louis his daughter in marriage, and named him vicar-general and lieutenant of the empire in Austria and Styria, 1277.

The Palatinate was now definitely in the Bavarian house. Rudolf, the next count, was the son of Ludwig. His brother, the Duke of Bavaria, eventually became emperor as Ludwig IV. (1313); and a great quarrel between the brothers resulted in the defeat and banishment of the count, who died in exile in 1319. His son Adolf, however, became reconciled to the emperor, and was restored to his father's dignity; and the electoral vote for the empire was now declared to lie alternately with the County Palatine and with the Duchy of Bavaria. The next count, Rudolf II., the Blind, succeeded his brother Adolf in 1327; and he is noticeable as the founder of the famous University of Heidelberg (1316). A third brother, Rupert, succeeded in 1339, and his reign is memorable as that in which the County Palatine was definitely named an electorate by the Golden Bull of 1356, given by the Emperor Charles IV., which fixed all the details and ceremonies observable in the great work of electing the king (emperor) of Germany. At this time there were seven princes (electors) who had a right to vote for the emperor. Count Rupert II., who succeeded his uncle and namesake in 1390, was among the foremost in opposing the worthless Emperor Wenceslas; and on the emperor's deposition in 1400, Count Rupert III. (his son, who succeeded on the death of Rupert II. in 1398) was elected emperor in his stead. He reigned till 1410.

The empire passed away again from the Electors Palatine, but they remained very powerful princes. Ludwig III., son of the Emperor Rupert, married a daughter of Henry IV. of England, and is further noteworthy as presiding over the famous sittings of the Council of Constance, at which John Huss, and later on Jerome of Prague, were condemned to the stake for heresy (1415-16); further, it was to him

that the custody of the deposed Pope John XXIII. was committed. The second count after Ludwig III. claimed the duchy of Bavaria for his son, and was strong enough to go to war with the Emperor Maximilian on the subject. He was defeated, and much territory was added to the imperial fiefs at the expense of the Bavarian house. The last elector immediately descended from Ludwig III. was Otto, called the Magnanimous, duke of Neuburg, who embraced Protestantism and joined the league of Schmalkald 1542.

At Elector Otto's death in 1559, the county passed into the family of Simmen, the first elector being Frederick III., a strong Protestant, honoured with the surname of "the Pious" from the way in which he pleaded the cause of the Calvinists at the Diet of Augsburg in 1556, and helped the oppressed Huguenots in France in 1567. His grandson, the Elector Frederick V., married our English princess Elizabeth, sister of Charles I. of England; and the princes Rupert and Maurice, who figure so largely in our Civil War, were the children of this princess. She was an ambitious woman, and urged her husband to accept the crown of Bohemia, which the insurgents in that country offered to him. He did so, and was crowned in October, 1619. From the circumstance that he was driven from his new throne in 1620, he was called the "winter king." The imperial general Tilly utterly defeated him near Prague, November, 1620, and he fled to Holland. His father-in-law, James I. of England, intervened for him in 1621; but he was nevertheless put to the ban of the empire, and the Palatinate, with the electoral dignity, was annexed to Bavaria in 1623. Frederick died at Mainz in 1632. Karl, son of the "winter king," was, however, by the treaty of Westphalia, restored to the Lower Palatinate and to the electorate, an eighth vote being especially created for the purpose in 1648. He joined the league against France, and the Palatinate was in consequence devastated by the French under Turenne in 1674. The line of Simmen died out with his son in 1685.

Philip, Count Palatine of Neuburg, a descendant of Ludwig III., next became elector, and at once re-established Roman Catholicism. The succession now became split up among the sons and grandsons of Elector Philip, one of the latter, Karl Theodor, eventually renouncing the Palatinate to Bavaria in his own person (1777). The French conquered the Palatinate again (the third time) in 1794, and the next elector, Duke Maximilian of Zweibrücken (another branch of the Neuburg house), who succeeded in 1799, was deprived of the Lower Palatinate in 1801, at the peace of Lunéville, in favour of Baden, Hesse-Darmstadt, and Nassau, as to the territories eastward of the Rhine; the remainder going to France. A new division in 1814 (Paris), and again in 1815 (Vienna) allotted the territories beyond the Rhine between Bavaria (which took the greatest share), Hesse-Darmstadt, and Prussia.

PALATINE COUNTIES. Three English counties, Chester, Lancaster, and Durham, are counties palatine. Pembroke, in Wales, was also a county palatine; but its palatine jurisdiction was taken away by 27 Henry VIII. c. 26. Counts palatine were of feudal origin. Selden says, "The name was received here, doubtless, out of the use of the Empire of France, and in the like notions as it had in that use" ("Titles of Honour," Part II.)

The counts palatine in England had *jura regalia*, or judicial rights, within their counties, subject only to the king's general superiority as suzerain. They had each a Chancery and Court of Common Pleas; they appointed their judges and magistrates and law officers; they pardoned treasons, murders, and felonies; all writs and judicial proceedings issued and were carried on in their names. Many of these powers, such as the appointment of judges and magistrates, and the privilege of pardoning, were abolished by 27 Henry VIII. c. 24, which also

provided that all writs and processes in counties palatine should from that time bear the king's name. The statute, however, expressly stipulates that writs shall be always witnessed in the name of the count palatine.

The county of Chester is a county palatine by prescription, being commonly supposed to have been first given with regal jurisdiction by William I. to Hugues d'Avranches. It was annexed to the crown by letters patent in the reign of Henry III., and since that time it has always given the title of Earl of Chester to the king's eldest son, and is preserved in the crown as a county palatine when there is no Prince of Wales.

The county of Lancaster appears to have been first made a county palatine by Edward III., who in the twenty-fifth year of his reign, in his patent of creation of Henry the first duke, granted him the dignity of a count palatine, and afterwards, in the fiftieth year of his reign, granted the same dignity by letters patent to his son John, duke of Lancaster. Henry IV. was duke of Lancaster by inheritance from his father John of Gaunt at the time of his usurpation. Upon the attainder of his grandson Henry VI., soon after the accession of Edward IV., the duchy became forfeited to the crown, and an Act of Parliament was passed to incorporate the county palatine with the duchy of Lancaster, and to vest the whole in Edward IV. and his heirs for ever. Another Act of Parliament, passed in the reign of Henry VII., confirmed the duchy to the king and his heirs for ever, and from that time it has been united to the crown. The queen bears, as one of her titles, that of Duchess and Countess Palatine of Lancaster, and assumes it when she travels *incognito*.

Durham is a county palatine by prescription. Durham continued as a county palatine in the hands of a subject till the year 1836, the bishop having been prince palatine, and possessing *jura regalia* till that time. By the statute 6 & 7 Will. IV. c. 19, the palatine jurisdiction was separated from the bishopric and transferred to William IV., and vested in him and his successors as a franchise separate from the crown, together with all forfeitures, mines, and *jura regalia*. The jurisdiction of the courts was expressly excepted from the operation of the Act.

In Scotland *regalities* were of similar import as palatine counties in England, and were abolished by the Jurisdiction Act, 20 Geo. II. c. 50.

PALATINE HILL (Lat. *Mons Palatinus*), the central of the seven hills on which ancient Rome was built, and the traditional site of the earliest Roman colony. Its summit is about 160 feet above the sea level, and its form is that of an irregular quadrangle. The name of this famous hill is doubtless originally derived from that of the god PALES, the ancient Roman equivalent for PAN, whose worship, like most of the other indigenous Italian deities, became later on absorbed by the growing imitation of Greek mythology. In the early times of the city, Pales, as god of flocks and herds, would be an appropriate deity for the stronghold of the struggling community. This hill of the Palatine was the beginning of Rome. The earliest city, "Roma quadrata" (square Rome), was inclosed by a somewhat square wall surrounding the Palatine alone; and the gates and walls of this primitive city were visible down to the close of the republic and afterwards. We can even still detect portions of it, and lovers of Roman history reverently gaze on the actual work either of Romulus or of his immediate successors. The work is "cyclopean," i.e. without mortar and of massive stones, very carefully squared, holding together by their own weight and accurate fitting, possibly aided by internal clamps. Tacitus, writing at the close of the first century of our era, described the ancient ring-wall of the Palatine from his personal observation in his own vivid way.

Although as the city grew, the stronghold was moved from the Palatine to the neighbouring Tarpeian rock, now

called the Capitol, because it was steeper, smaller, and better fitted for purposes of defence, yet the younger fortress never attained as fast a hold upon the imagination of the Romans as their original home. On the Palatine were seen for long centuries traces of the *mundus*, the symbol of settlement, where the colonists from Alba had deposited a sample of their entire outfit and a clod of earth from their father's home. The original assembly-place of the *curies* was there; there dwelt the leaping-priests of Mars, the Salii, who had charge of the sacred shields of the god, tutelary deity of Rome, father (as the legend had it) of Romulus; there was, and still is, the Lupercal, the sanctuary of the wolves who suckled the infant twins, Romulus and Remus, when they were cast out; there was preserved for long ages the straw-thatched cot of Romulus (Dionysius of Halicarnassus saw it, for instance) and the shepherd's hut of his supposed father Faustulus, the shepherd who found him; there dwelt the powerful high priest of Jupiter, the flamen Dialis; and there was the antique votive temple to Jupiter Stator, commemorating the "delayer's" preservation of the state on a memorable occasion when flight and ruin were stayed.

The splendid residences of the great men at the close of the republic, and of the emperors who succeeded them, beginning with Cæsar himself, which were mostly built upon the Palatine, give us our word *palace* (*palatium*). The house of Livia, mother of the Emperor Tiberius and wife of the Emperor Augustus, still stands there, in excellent preservation; so does a large part of the palace of Tiberius. Later emperors monopolized more and more of the hill; Caligula covered all the steep side towards the Capitol with his vast arches, sweeping away the historic houses of Julius Cæsar and Cicero overlooking the forum. He began a bridge, which was to spring across the valley to the Capitol, that the mad emperor might "the better converse with his colleague Jove," whose principal temple stood on the Capitol. Gradually the great buildings of the palaces in successive reigns extended towards what is now the Colosseum, the Capitol end being filled already. Nero covered the whole hill with his colossal Golden House, which even extended over to the Esquiline, beyond the fine lake which then covered the present site of the Colosseum. Much of this was destroyed by Vespasian, who drained the lake and pulled down what of the unfinished but imposing ruins of the palace he did not require. The lofty work of Septimius Severus at this end of the Palatine, including a full-sized racecourse within the palace, may yet be seen. With Alexander Severus (the next emperor but two to Septimius, Caracalla and Elagabalus only coming between them) the emperors ceased to live upon the Palatine. It was used as a fortress in the dark ages, but still existed, though ruinous, until at last the popes pulled its palaces to pieces in mediæval times, for the sake of their columns, &c.; as, for instance, Sixtus V., who destroyed one of the finest remaining buildings, the Septizonium, to enrich the Vatican. Thus the Palatine has come down to us full of ruins of the most interesting monuments of ancient Rome, crowded thickly together in its limited space.

Paul III., the Farnese pope, in the time of our Henry VIII., possessed much of the Palatine. He began a Renaissance villa, which was to overlook the forum, the "loggia" of which still remains as he left it, and he laid out the summit of the hill as gardens, still called the "Orti Farnesiani." The heiress of Pope Paul married Philip V. of Spain, and his son, Don Carlos, inherited, so that this part of the hill passed with him to the crown of Naples. Thus it comes that so many fine treasures of the Palatine are in the Naples Museum, treasures which ought to have been in Rome. The Emperor Napoleon III. bought the Farnese Gardens from Francis II. of Naples for £10,000, and at once began to excavate them, with splendid results. He had undertaken the "Life of Cæsar," and desired to

illustrate his book by discoveries on the spot. Eventually this passed to the city of Rome, which paid Napoleon in 1870 (after the fall of the empire) about three times his original purchase money for it. In 1857 another great piece of the hill had been given to the city by the Czar of Russia, who had bought it as a vineyard and had made fine excavations, and Pope Pius IX. bought the vineyard containing the palace of the elder Severus. There still remain the "villa nilla" and a monastery encumbering the Palatine, but these will soon disappear, and the important excavations will then tell the full story of the place, this cradle of the greatest city and the greatest people of the world.

PALE, in heraldry, is the name of one of the chief ordinaries, consisting of a vertical strip down the middle of a shield, one-third the width of the shield. When a shield is divided vertically it is said to be *party per pale*, and when changes are borne upon a shield, one above the other in a vertical pile (like the three lions of England), they are said to be *in pale*. The *pallet* and the *endorse* are diminutives of the pale, being respectively a quarter and an eighth of its width. Examples are given in the Plates illustrating the article HERALDRY, which also may be referred to.

PALE, THE, was a district of Ireland, immediately round the seat of government, over which the English rule was acknowledged and obeyed - all beyond the Pale being held by a very imperfect tenure. The designation dates from the reign of John, but the extent of the district so described has differed at various times, altering with the territory actually subject to English law. Generally speaking, however, the Pale may be said to have been a strip along the east side of the island, comprising the counties of Dublin, Meath, Carlow, Kilkenny, and Louth. During the Irish rebellion of 1641 the English of the Pale joined the Irish Catholics in their cruel barbarities.

PALÆA, a botanical term given to the inner *bracts* of the flowers of GRASSES, and to the small scales stationed upon the receptacle of COMPOSITE between the florets. The Latin word means chaff.

PALEMBANG, the chief town of a residency of the same name in Sumatra, situated on both sides of the Moesi, 52 miles from its mouth on a low though healthy site. The river forms a fine harbour, allowing the largest vessels to reach the town: the European, Arabian, and Chinese inhabitants live chiefly in floating houses called *rakits*. A large trade is carried on; boats from the interior bring down rice, india-rubber, gutta-percha, cotton, and rattan canes, and foreign commerce extends to Europe, China, Siam, Java, and Singapore. The town consists chiefly of houses of bamboo, covered with thatch, but has several substantial houses of stone, including the palaces in which the native princes and their families used to reside before the kingdom of Palembang was taken possession of by the Dutch. Population about 25,000.

PALEN'GIA, a town of Spain, the capital of a province of the same name, situated in a fertile plain on the left bank of the Carrion, which is a feeder of the Pisuerga, and is crossed at this place by two bridges. The town contains several churches and convents built in the Gothic style, the most remarkable being the Cathedral of San Antolín. It has ancient walls of great thickness in good preservation. The inhabitants, who number about 14,000, are chiefly engaged in the manufacture of woollen cloths and blankets. Palencia gives title to a bishop, and is 118 miles north-west of Madrid. It was here that the marriage of the Cid to Ximena Gomez was celebrated. The ancient name was *Pallantia*, and the town contained the first Spanish university, removed to Salamanca in 1239.

PALERMO, a town of Italy, the capital of the island of Sicily, and of a province of the same name, is situated on the northern coast of Sicily, on a fine and fertile plain between two mountain ridges and the sea. The town is built in the form of an amphitheatre, facing the sea, and is

surrounded by an old wall with sixteen gates. Next to the sea is the strong fort of Castell-a-Mare. The port is enclosed by a mole, terminated by a lighthouse and a battery, and there is a second interior harbour. The sea views are beautiful, particularly that from the Marina, a superb promenade by the shore. The city contains a fine central avenue, large squares, some handsome streets, and public fountains. The houses are built nearly in the same style as those of Naples, with flat roofs and terraces, and balconies with Venetian blinds. The most remarkable buildings are—the royal palace, an old edifice fortified like a castle, with a fine hall, a spacious court, and a splendid chapel. On the summit of the palace is the observatory. The cathedral is a magnificent Gothic structure, built about the end of the twelfth century by the English Archbishop Walter of the Mill. The Church "del Gesù" is remarkable for its architecture and for the richness of its marble decorations, its paintings, and sculptures. The university, founded in 1417, has a valuable library. There is a museum of antiquities, with some fine statues, and a good collection of Græco-Sicilian medals. Besides the above, Palermo contains several beautiful churches, a great hospital, several hospitals and asylums, two monti de pietà, the archbishop's and many fine palaces of the nobility, numerous theatres, military barracks, castle, and a promenade along the sea-side, which leads to the public gardens. There are numerous learned societies, a few public schools, many nurseries, and an English church.

Palermo is an archbishop's see, and the residence of the military commandant of the island. Its climate is one of the most delightful in Europe, the mean temperature of the year being 63° 7' Fahr. The city contains the library of the commune, with 75,000 volumes; an arsenal and shipbuilding yards; and there is an extensive import and export trade. The principal manufactures carried on are cotton goods, straw hats, silk gloves, chemical products, and paper. In a valley in the vicinity, called *La Conca d'Oro* ("the golden shell"), the finest lemons in Europe are grown, and the essence of lemon is made. Large quantities of oranges are also grown.

The commerce of Palermo is considerable. In 1873 the port was much improved by the construction of a break-water and the lengthening of the mole, and can now accommodate large vessels. The chief exports are fruit, wine, sulphur, sumac, and oil. Two fine roads lead from Palermo, one to Monreale, and the other to Termini. The town is also connected by railways with the chief commercial centres of the island.

Palermo, under the name of *Panormus* ("All-port"), was originally a Greek settlement. It afterwards became subject to the Carthaginians, and next became a Roman colony. The Arabian emirs who ruled Sicily for several centuries made Panormus the capital of the island, and the Norman kings after them fixed their residence there. In 1282 it was the scene of the massacre called the "Sicilian Vespers," which originated in an insult offered to a lady by a Frenchman, and ended in the entire destruction of his countrymen throughout the island. When the island became united to the kingdom of Naples, Palermo retained the rank of capital of the kingdom of Sicily; and the court of Naples resided here from 1806 to 1815. On the 27th May, 1860, Garibaldi attacked and took the city by a *coup de main*, and since that time it has formed part of the kingdom of Italy. The population in 1882 was 244,991.

PALES, PALI'IA. Pales, an ancient native Italian god, and presumably the divinity originally worshipped on the Palatine Hill, the cradle of ancient Rome, was the protector of flocks and herds, and had many of the attributes, though not the figure, of the Greek Pan. Some antiquaries have sought to show that Pales was originally a female divinity, but there seems no rational cause for this supposition, and the ancients themselves expressly

state to the contrary, e.g. Servius Maurus Honoratus in his great commentary on Virgil ("Georgics," iii. 1).

The festival of the Palilia, in honour of Pales, was celebrated on the 21st of April. The flocks were purified by incense, and fragrant boughs were hung in the stables, afterwards bonfires were lit, and both the flocks and their shepherds were made to run three times through the fire for purification. This ceremony in later times was performed symbolically, and the Palilia lost its connection with Pales, being regarded as the festival of the foundation of the city.

PALESTINE (*Palestina*, *Philistia*), or the Holy Land, a country of South-western Asia, under the government of Turkey, formerly included in the province of Syria, but now chiefly constituting a separate vilayet, is a narrow strip of land along the Mediterranean coast, having a length of about 160 miles and a breadth of about 70 miles, and bounded on the E. by the River Jordan, N. by the Lebanon range and the valley of the Leontes (Litany), and S. by the desert of Sinai. The area does not exceed 12,000 square miles. This comparatively insignificant territory is the famous "Land of Israel" or "Canaan," which in the days of old was blessed by so remarkable a fertility that in the time of Moses its fighting men numbered 500,000, which, on the most moderate estimate, would give a total population of 2,500,000; and probably in the flush of Jewish prosperity the kings of Israel and Judæa reigned over 7,000,000 subjects. The present population is estimated at about 650,000, or according to Turkish returns, at about 300,000, of which a very small proportion are Jews.

Topography.—The physical aspects of Palestine are remarkably varied and interesting. (1) The first and most obvious feature is the *valley of the Jordan*, the deepest depression of the kind on the earth's surface, falling to 1292 feet below the level of the Mediterranean, in the basin of the Dead Sea. The valley is hemmed in on both sides by a range of steep and lofty hills, gradually drawing further apart from each other as they approach the south; so that it widens from 5 miles at its head to 18 or 20 at its mouth, where it opens upon the plains of Moab and Jericho. Thirty to forty feet lower than the average level of this greater valley lies a lesser vale or hollow, forming the channel of the river, which, when swollen by rains, completely fills it, and even overflows its borders. This lower valley or glen varies in breadth from three-quarters to 2 miles, and its edges are clothed with the most luxuriant vegetation, so that it may be likened to a long and narrow oasis in a sterile desert. In the northerly part of its course the Jordan forms the Lake of Tiberias (often called the Sea of Galilee), which extends about 14 miles in length and 7 in breadth, with an area of 76 square miles. Its waters are limpid, sweet, and wholesome, and abound in fish. The hills which surround the lake are precipitous, and the general character of the landscape is very fine. Its shores, now haunted by immense numbers of wild fowl and feathered warblers, were formerly occupied by important towns, whose site is a matter of speculative controversy. Capernaum is supposed to be represented by *Tell Hoom*; Chorazin, by *Gerezzi*; but the locality of Bethsaida, the birthplace of Andrew, Peter, and Philip, has not been identified. Near Kalaat Hanun, or the Castle of the Pigeons, an ancient fortification commanding a pass in the hills, a great defeat was sustained by the Crusaders in 1187, which made Saladin undisputed master of all Palestine. In the fierce wars between the Romans and the Jews, the former won a signal victory over their opponents on Lake Tiberias itself. Both the lake and its shores, says Josephus, were covered with blood and mangled bodies to such an extent that the very air was infected.

The Lake Tiberias is 328 feet below the level of the Mediterranean. From thence the Jordan continues its

downward course, at the rate of 5 or 6 miles an hour, for 65 miles, to the DEAD SEA.

In the valley of the Jordan the balsam tree, the date, indigo, oleanders, willows, and tamarisks flourish; but at a little distance from the river all this rich and beautiful vegetation disappears, and the higher grounds present a dreary aspect of leafless desolation.

(2) The next prominent feature is the *littoral plain*, which extends inland to the border of the Ghor or valley of the Jordan and the range of the mountains of Judah. Its seaward edge is a sandy desert, except in the immediate neighbourhood of Casarea and Joppa, but towards the interior it presents every sign of fertility, and the hills are clothed with flourishing woods of oak, myrtle, hawthorn, and acacia, while the hollows bloom with flowers, and the air is impregnated with aromatic odours. The plain of Philistia, which occupies almost all the maritime district, is about 15 miles broad; its rich brown loamy soil is without a stone. Here the pleasant towns of Gaza and Ashdod (Ēśdūd) are surrounded by gardens of apricots, mulberries, and other fruits, by groves of sycamores, olives, and palms. Wheat is cultivated over the whole region, and with great success, abundant harvests regularly repaying the labour of the husbandman. The plain of Sharon lies to the northward, and is bounded in that direction by the famous height of Mount Carmel, where an important Latin convent has stood for centuries. It is a rich and picturesque tract, watered by several streams, and once the home of a thriving population. The range of Mount Carmel separates it from the central plain of Esdracelon or Jezreel, at whose north-eastern extremity rises Mount Tabor, at its south-eastern the hills of Gilboa. This plain or valley extends for about 20 miles from east to west, and about 13 miles from north to south. The Arabs call it *Merj ibn Amīn*—the plain of the sons of Amīr. Its fertility was once proverbial, but it is now chiefly occupied by tribes of wandering Bedouins, who live upon the plunder of caravans and travellers. Scripture history invests it with associations of the highest interest, for here Gideon triumphed over the enemies of the chosen people; here Saul was overthrown; and here, or in its neighbourhood, were anciently planted the cities of Nain and Nazareth, Endor, Jezreel, and Tabor.

(3) The last distinctive feature of the physical geography of the Holy Land is its *central table-land*, an area 1600 feet above the sea, and covered by numerous ranges of hills, forming the extended spurs of the great chain of the Lebanon. The principal elevations are Mount Hebron, 3029 feet; Mount Gerizim, 2819; Mount of Olives, 2643; Mount Tabor, 1843.

Climate of Palestine.—Owing to its peculiar physical features the Holy Land possesses almost every variety of climate. In the plain of Jericho and the valley of the Jordan it is of a tropical character; on the coast the warm air is tempered by refreshing breezes; at Jerusalem the mean annual temperature is 65°, resembling that of Madeira; in the hilly regions snow falls in January and February, while during the summer months the nights are marked by heavy dews. The winter is genial enough, however, in the maritime lowlands, and the orange and banana flourish in the open air. The wet season extends from the autumnal equinox to five or six weeks after the vernal, being the “first” and “latter” rains of Scripture. Then the earth is covered with flower and leaf until the heat of summer comes, and all verdure disappears and man longs for “the shadow of a great rock in a weary land.”

Rivers.—The rivers of Palestine are the Jordan, El-Arish, the Besor, Belus, Chorsas, Esheol, Sarkon, Kanah, and Kishon. Most of these are mere brooks, whose channels are dry in summer. The JORDAN rises nearly in the latitude of Tyre, and flows southward in the valley already

described, feeding the lakes of Samochonitis and Genesaret, and emptying its waters into the Dead Sea. The Arabs call it *Sheriat-el-Kebir*. Its sources are situated among the mountains of Anti-Lebanon, and unite in Lake Bahr-Haleh, lat. 33° 6' N., lon. 35° 30' E. It is a swift, dark-coloured stream about 200 miles long, including windings, but not more than 70 in a direct course. At its mouth it is 200 feet wide. Numerous islands are scattered along its channel, which is also interrupted by twenty-seven considerable rapids. It empties daily into the Dead Sea about 6,090,000 tons of water.

The Kishon rises in Anti-Lebanon, about lat. 35° 30' N., flows in a north-west direction through the plain of Esdracelon, and falls into the Mediterranean south of Acre.

Mountains.—Palestine is a land of mountains, being traversed by various offshoots of the great chain of Lebanon. A mountain range commences in Syria south of the ancient Orontes, and stretches to the south as far as the sources of the Jordan, where it divides into two branches, which continue their course nearly parallel to each other, and inclose between them the valley of the Jordan and its lakes. These two ranges diverge from each other at the head of the Gulf of Akaba, the one running along the eastern coast of the gulf and terminating on the shores of the Red Sea, the other along its western coast and terminating in the mountains of Sinai. The mountains of *LEBANON*, which are a part of this great system, form the northern boundary of Palestine. They consist of two parallel chains, the western called *Libanus*, and the eastern *Anti Libanus*. The summit of the western chain is bare and sovery; but the lower slopes, especially on the western side, are inhabited and cultivated. Among the trees which grow upon them are the remains of the celebrated cedars of Lebanon; but of the magnificent groves which once clothed these heights, and furnished the cedar-wood for Solomon's temple, only a few patriarchs remain. These are massive as columns of granite, and rear their heads aloft as if crowned with the plume of centuries. Out of a grove of 400, they probably number only eleven or twelve. These remnants of the past are now very jealously preserved, and a solemn mass is annually celebrated in their shadow on the feast of the Transfiguration. Almost all the mountains of Palestine may be regarded as belonging to these two principal ranges. The most remarkable are Mount Carmel, which forms a bold and picturesque promontory in the Mediterranean; Tabor or Jebel Tur, at the north-east of the plain of Esdracelon; Ebel and Gerizim, in the valley of SAMARIA; Gilead and Pisgah (or Nebo), on the east side of the Jordan; and Zion, Mount Moriah, and OLIVET, in the neighbourhood of JERUSALEM. Mount Tabor, which is generally reputed to have been the scene of the Transfiguration, may be compared to a truncated cone, the summit forming a pleasant table land, and the sides sloping gently into a sea of verdure. It is described as a remarkably fine elevation, having a soil productive of the richest herbage, and adorned with groves of noble trees. Its crest, about half a mile long and a quarter broad, is surrounded by a strong wall, built by Josephus in the space of forty days. It commands a beautiful panorama, in which the blue waters of the Mediterranean, the green mountains of Gilboa, and the rich plains of Esdracelon and Galilee are prominent features.

Judea, or the southern part of Palestine, is covered with hills, which are divided by valleys and torrents, and are for the most part of moderate elevation. They are composed of a friable rock, particles of which are washed down by the torrents, and form rough and unequal terraces on their slopes. In ancient times these terraces were planted with the olive, the fig-tree, and the vine. At present they are for the most part barren and desolate. The most mountainous part of Judea is the district round Jerusalem.

Limestone is the prevailing constituent of all the mountains of Palestine, as of Asia Minor and Greece. Its general character is that of a hard, calcareous rock, sonorous when struck, and of a whitish or pale yellow colour. It is, in short, a very hard species of limestone, disposed in strata variously inclined, and, like all limestone strata, largely excavated into caverns, to which frequent allusion is made in the Scriptures. Some of these are capable of containing 1500 men, and one near Damascus would even afford shelter to 4000. Black basalt, sandstone, micaceous stone, reddish brittle earth, beds of chalk, and a little coal are met with in detached spots. There are but faint traces of metallic veins. The Dead Sea and the shores of the Mediterranean yield an abundance of salt. Hot springs and asphaltum pits occur in many parts of Palestine, and, like the Dead Sea and its vicinity, afford many indications of volcanic action.

From the general disposition of the high lands in Palestine it follows that the chief valleys are longitudinal, and run from north to south. The transverse valleys have a general east and west direction, being formed by the offsets of the principal mountain ranges. The plain country is almost entirely confined to the low land along the Mediterranean, west of the central range of mountains. The chief valleys, lying to the east of that range, are the Bekka between Lebanon and Anti-Lebanon, and the basin of the river Jordan.

Samaria is less mountainous than either Galilee or Judea; it is magnificently wooded, and endowed with a wonderful fertility. Many of the lateral valleys of Galilee and Samaria, mentioned by name in Scripture, are small in extent but beautiful in character. On the east side of the Jordan lie the rich pasture-lands of Argob and Bashan, extending from Mount Hermon to the river Jarmouk, a few miles south of the Lake of Gennesaret. South of this was the land of Gilead, the limits of which are not precisely defined. The south of Palestine touches the great sandy desert which extends to Egypt and Sinai. It bears various names, of which that of the Desert of Paran seems to be used with the widest signification.

Botany.—The botanical wealth of the Holy Land is very varied. In the northern and elevated districts grow the oak, pine, elder, hawthorn, and aænia; in the southern valleys and plains the traveller meets with an abundant growth of olives, figs, carobs, sycamores, and palms. The vine, pear, quince, plum, apricot, apple, orange, lime, and banana are extensively cultivated, and cotton, millet, wheat, rice, barley, and various European vegetables also employ the husbandman's labour. The botany of the Ghor of the Jordan is completely tropical. Elsewhere the landscapes are brightened by the anemone, geranium, pink, poppy, and ranunculus. Mulberry and fig-trees are plentiful throughout Palestine. Large quantities of wine are annually manufactured and consumed, while fruits and olive-oil form important articles of commerce. It is easy to understand, even now, how in truth Canaan seemed to the Israelites, approaching from the wilderness, a land flowing with milk and honey, with wine and oil.

History.—The most ancient record which we possess of Palestine is connected with Abraham's migration from Mesopotamia to dwell among its hills and valleys. It was then inhabited by the Canaanites, a people descended from Canaan, the fourth son of Ham and a grandson of Noah. It was afterwards divided among a number of independent tribes, some of whom were agricultural, some nomadic, and some maritime in their habits. Thus, the Phœnicians dwelt on the north, and the Philistines on the south coast; the Hivites among the spurs of the Lebanon; the Canaanites in the centre, from the Jordan to the sea; the Gergashites skirted the Lake of Tiberias on the east; in the mountainous country of the south clustered the Hittites, Perizzites, Amorites, and Jebusites; while to the east of

the sacred river were the Kadmonites, Kenites, and Kenizites. Then came the great invasion of the Israelites under their lawgiver Moses, when all the country beyond the Jordan was conquered and occupied by the tribes of Reuben and Gad and the half tribe of Manasseh. Joshua completed the work, and the rich land west of Jordan fell to the ten tribes and the other half tribe of Manasseh—Judah and Benjamin obtaining the "lion's share" of the southern districts. Saul and David formed these twelve tribes into a compact kingdom, which under Solomon reached its greatest development and attained the summit of its prosperity: "Judah and Israel dwelt safely, every man under his own vine and under his own fig tree, from Dan even to Beersheba, all the days of Solomon." Rehoboam, the son and successor of the wise king, undid what his great father had so laboriously wrought, and the kingdom was separated into the two independent and frequently hostile monarchies of Judah and Israel. After various vicissitudes the latter, often designated Samaria, was conquered by the Assyrians and its inhabitants were transported to Babylon. The kingdom of Judah was overthrown by Nebuchadnezzar in 588 B.C. and its population carried into captivity. After the fall of the Babylonian Empire, Palestine was ruled, first by the Persians and afterwards by the Macedonians. Finally, crushed and oppressed by the Syrian kings who succeeded Alexander the Great, the Jews broke out into open revolt, and under the guidance of the Maccabees recovered their independence and re-established the kingdom of Judah.

For no long period did they enjoy liberty, for in the year 63 B.C. their land was conquered by Pompey for the Romans. Thenceforward it was a tributary of Rome, though for some generations nominally governed by its own kings; but even this vestige of its former power was swept away, and its capital demolished by Titus Vespasian, 70 A.D. Under the Romans it was divided into three provinces—Judea, Samaria, and Galilee. When Constantine established the Empire of the East, it became a portion of it, and was known under the nomenclature of *Palestina Prima, Secunda, and Tertia*. It then enjoyed a brief interval of peace. In 636 the Mohammedan power appeared upon the scene, and after a short contest Palestine, under the Caliph Omar, became a Mohammedan province. The cruelties inflicted by the Moslems on the Christian pilgrims who still made their way annually to the Holy City and the sacred places associated with the career and work of the Saviour, aroused the indignation of Christendom. Peter the Hermit preached, Pope Hildebrand sanctioned, and Godfrey of Bouillon led the first Crusade, the object of which was to rescue Jerusalem and Palestine from the sway of the infidel. The Christian warriors so far succeeded that from 1099 to 1187 Jerusalem became the capital of a Latin kingdom; but the Moslems did not lightly forego so valuable a prize, and a long series of campaigns resulted in the final subjugation of the Holy Land by Saladin. The Egyptian sultans ruled it until Selim I., in 1517, incorporated it into the Turkish Empire.

PALESTRINA, the ancient *Præneste*, an episcopal town of Central Italy, 20 miles east of Rome, was built on the site of the Temple of Fortune erected by Scylla. There are remains of the old walls, formed of large irregular blocks of stone, some interesting churches, an old palace of the Barberini family, and a castle. The town now contains about 6000 inhabitants, who manufacture coarse woollen goods. Many statues and other remains of antiquity have been found here. In the middle ages this place was the chief stronghold of the family of Colonna, who often disputed with the popes the dominion of the Campagna, and of Rome itself.

PALESTRINA, GIOVANNI PIERLUIGI DA, was born at Palestrina, near Rome (the ancient *Præneste*, whence his Latin name of *Prænestinus*), about the year

1524, according to Baini's reasoning, but some fix his birth as late as 1528, and others as early as 1514. The public registers were destroyed by the Spanish soldiers in 1557, and the indirect evidence which now remains is conflicting. He was, however, still quite young when in 1540 he came to Rome and became a pupil in the first school of music founded in the Eternal City. This was the school of the future Huguenot martyr, Claude Goudimel, a native of Besançon. Palestrina was appointed master of the chapel in the Vatican Capella Giulia by Pope Julius III. in 1551. In 1555 Julius III., who esteemed him greatly, and to whom he dedicated the first book of masses ever written by an Italian for the Pope (all the greatest composers up till now being Netherlanders), appointed Palestrina, quite illegally, to a well-paid post as one of the singers of his private chapel. The same year Julius died, and so also did Marcellus II. his successor. In May Cardinal Caraffa succeeded to the papal throne, under the title of Paul IV., and finding that Palestrina had quitted a state of celibacy, and had a poor voice, abruptly dismissed him. For this Paul IV. has been unjustly blamed. The chapel was in a state of great disorder, and it behoved him at once to set things straight. Palestrina was clearly there against rules; a company of celibate singers had no place for a married man with no voice to speak of, and his power as a composer was nothing to the point. That Paul did not desire to injure him nor to personally disgrace him is shown by his conferring a pension upon him. Palestrina became maestro di capella at the Lateran Basilica till 1561, and for ten years after that to the Basilica of St. Maria Maggiore. In 1571 he was restored to his post in the Vatican.

During the above period, however, the Council of Trent, among other matters, took the state of ecclesiastical music into serious consideration, and appointed two cardinals, whom they charged with its reform. By their direction Palestrina produced three masses, of which the third and last was the composition known under the title of "the Mass of Pope Marcellus." Pope Pius IV., before whom this mass was performed, was enraptured, and compared it to the heavenly melodies which the apostle John heard in his ecstatic trance. It was like a flood of pure light after theatrical flashes of artificial flame when these grand and simple harmonies spersed the tricky productions of the decadence of the great Netherlandish school. Furthermore, Palestrina had been careful to use only the words of the Mass, and to set them expressively to music, both being in complete opposition to the prevailing practice, which was to write the sacred words as musical counterpoints to some popular song of the day, the tenor singing this tune *words and all* (and sometimes they were far from becoming words, moreover), while the bass, the duplum, and the triplum (or treble) sang the *Credo* or the *Sanctus* above and below him, the melodies simply being suited to the prime tune, and having no relation to the sense of the words to which they were sung. In fact, church music was simply a field for perverse and most irreverent ingenuity; and all the best minds in the Roman communion revolted at so great a scandal. It was seriously in contemplation to deny the use of music in the Mass altogether. From this fate the wise decision of the Cardinal (St. Carlo) Borromeo saved the church, by his invitation to Palestrina to invent a new form of composition which should be free from all these glaring defects, and inaugurate a new era in the music of the divine service. On the restoration of Palestrina to his office his fame spread widely, and to his other appointments was now added that of maestro to the pontifical choir (a new post created for him) and also to the Congregation of the Oratory.

He died 2nd February, 1594. His works are exceedingly numerous, chiefly ecclesiastical. We reckon at least ninety-three masses, besides many probably lost—twenty-

one of these being for six voices, five for eight voices, and the rest for four voices—and many volumes each of hymns, lamentations, offertories, and magnificats. There are also two books each of madrigals for four voices and for five.

No complete edition of the master's works has ever been published. Therefore Baini, just before his death in 1844, arranged with Breitkopf and Härtel, the famous publishers of Leipzig, to begin this great and necessary work. He amassed material for the first two volumes, but his death put an end to the project. It was resumed, on a fresh plan, about fifteen years later; and it was not till 1862 that the first two volumes of the Palestrina edition, containing motets for five, six, seven, and eight voices, were published under the editorship of Theodor de Witt, who had ransacked the libraries and archives of Italy for years, and died long before the result of his researches was given to the world. A third volume followed in 1863, but after this another interval of eleven years elapsed before two more volumes of motets saw the light, the editor this time being Herr Franz Espagac, of the Royal Library, Berlin, who also died soon after he had seen through the press the eighth volume of the edition, containing hymns. The ninth volume, consisting of five-part offertories, was edited by Herr Franz Commes, of Berlin. Through the energy of Herr Haberl, who founded the Palestrina Society in 1880, the work has since been placed upon a more solid basis, and there is no reason to doubt its uninterrupted progress towards completion. It is deplorable, though not surprising, that the edition of the great Roman master's works will see the light not in his own country, but in Germany. Palestrina's work has become the common property of all who love the highest and most serious type of art, and the number of these is not at present very great in Italy. Even in other countries the interest taken in the Palestrina edition is not as universal as might be desired and expected. From a pecuniary point of view the great enterprise is not very encouraging, but in spite of this Messrs. Breitkopf and Härtel guarantee the publication of two volumes per annum, one containing a mass, the other madrigals and miscellaneous pieces, until the series reaches its completion with the thirtieth volume, which will appear in 1894, just 300 years from the date of the death of him whom Baini always styles *Il principe della Musica*, the Prince of Music.

Palestrina served no less than eleven popes, and was never paid more than the wages of an ordinary artisan. Indeed, it is incredible how he can have lived on the pittance recorded. He was usually without even the money to print his works, depending upon patrons for this office.

The great source of information on the life and career of this wonderful musician and excellent man is the most accurate and interesting memoir of Baini, head of the papal chapel in his time (Rome, two vols., 1828), a work still unfortunately awaiting translation into English.

PALEY, WILLIAM, D.D., an English theologian and ethical writer, was born at Peterborough in July, 1743, his father being at the time one of the minor canons of the cathedral. In 1745 his father removed to Giggleswick in Yorkshire, having been appointed head master of King Edward's school in that place, and in this remote region, then one of the wildest in England, the young Paley was educated under parental care, being in 1795 entered a sizar in Christ's College, Cambridge. He took his B.A. degree with the highest honours in 1763, and having taken orders he was in 1766 elected to a fellowship of Christ's College, becoming a junior tutor soon afterwards. His colleague in the office was John Law, son of Dr. Edmund Law, then master of Peterhouse, and afterwards bishop of Carlisle, to whom Paley was indebted for much of his subsequent preferment in the church. He

continued to reside at Cambridge for about ten years, lecturing upon moral philosophy; but in 1776 he vacated his fellowship by marriage, and retired to the living of Musgrave in Cumberland, which had been conferred upon him by the Bishop of Carlisle. To this the vicarage of Dalston was soon added, and after exchanging Musgrave for Appleby, he became in 1782 archdeacon of Carlisle. In 1785 he published his first important work in his "Principles of Moral and Political Philosophy," for the copyright of which he received the large sum of £1000. This work immediately obtained an extensive circulation. It was adopted as the ethical text-book at Cambridge, and passed through fifteen editions during the lifetime of the author. In 1790 he published his "Hæc Paulina," the most original of all his works, in which he traces the coincidences of passages in the epistles of St. Paul with passages in the Acts of the Apostles, with a view of establishing the genuineness of these writings, and the reality of the events they record. This was followed in 1794 by a more general work in the same field, his view of the "Evidences of Christianity," an admirable digest of the "Criterion" of Bishop Douglas and the voluminous materials collected by the diligence of Dr. Lardner. It brought the author a large accession of fame and preferment. Dr. Porteus, bishop of London, nominated him prebend of St. Pancras, the Bishop of Lincoln made him subdean of Lincoln Cathedral, and the Bishop of Durham presented him to the valuable rectory of Bishop-Wearmouth in 1795. The same year the degree of D.D. was conferred on him by the University of Cambridge. During the remainder of his life, his time was divided between Bishop-Wearmouth and Lincoln. In 1800 he was attacked by a painful disease of the kidneys, which, however, did not prevent him from writing his "Natural Theology," one of his most popular compositions, but his health continued to decline and he died 25th May, 1805. His first wife, who had borne him four sons and four daughters, died in 1791.

As an author he is distinguished, not so much for originality as for remarkable power of analysis and felicity of illustration, a shrewd clear intellect, and a masterly power in arranging and massing the arguments he advances in support of his theories. In his lifetime and for a generation afterwards, his writings were considered to afford irrefutable arguments in defence of theism and revealed religion; but the controversy at the present day is proceeding on different lines to those which were accepted in the previous century, and in face of the theory of evolution, and the results of modern criticism as applied to the history of early Christianity, his reasonings are deprived of much of their original force. With respect to the charges of wholesale plagiarism which have been made against him, as Professor Seth observes, "in the case of a writer whose chief merit is the way in which he has worked up existing material, a general charge of plagiarism is almost irrelevant." A complete edition of his works was published by his son, the Rev. Edmund Paley, in four vols. 8vo in 1838.

PALGRAVE, SIR FRANCIS, F.R.S., F.S.A., a distinguished historical antiquary, was born in London in 1788. The son of an opulent Jewish merchant named Cohen, he adopted the patronymic of his wife's mother on the occasion of his marriage in 1823. Bred to the law, he was called to the bar at the Inner Temple in 1827, but never attained to any particular eminence in the profession. He soon attracted attention in a different walk by some essays on the historical antiquities of Great Britain, and by his edition of the Parliamentary Writs for the Record Commission. In 1831 appeared his "History of England: Anglo-Saxon Period," for the Family Library; in 1832, his "Rise and Progress of the English Commonwealth;" in 1840, "The Merchant and the Friar," an imaginary history of Marco Polo and Friar Bacon; and in 1851-57,

his "History of Normandy and of England." These and other works abundantly testify to his great learning, untiring research, and critical perspicacity. They will always be largely consulted by historical students, but their cumbersome style and total want of that *vis viva* of genius which inspires with life the dry bones of the historical skeleton, will always militate against their general popularity. He received the honour of knighthood in 1832 as an acknowledgment of his valuable antiquarian services, and died on the 6th of July, 1861, aged seventy-three.

PĀLI, the sacred language of the Buddhist scriptures of Ceylon, Siam, Burma, and in fact of Southern and Further India generally, bears much the same relation to Sanskrit as Italian does to Latin. As we have in Europe the Romance tongues of Italian, Spanish, and French rising out of the decay of the original Latin, so in India the Prākṛit (vulgar) tongues arose out of the decay which set in when, soon after the commencement of our era, Sanskrit became a literary language and ceased to be the commonly spoken tongue; and the chief of these Prākṛit dialects is Pāli. The word Pāli is, in fact, a softening of Prākṛit. The Buddhist religious scriptures were written about the year 200 in the then vernacular (Pāli), as the Brāhmanic Vedas were written in Sanskrit when that was in its day the tongue of the people; and with the natural reverent conservatism of all religious faiths these scriptures are preserved in, and are thus the means of themselves preserving, tongues which have long since perished as mediums of interchange of living thought. When the Buddhists were driven out of the peninsula of India they fled to Ceylon and to Further India, carrying with them their scriptures and other writings in Pāli. Of these the chief are the Dhammapada or Buddhist doctrine; the two important histories of Ceylon (Lankā), from the earliest period down to the year 302 of our era, called the older and younger Mahāvamsa, the first of which was completed by the Buddhist monks of Anarādhāpura, the capital of the island, about the year 400; and five Jātakas or collections, each one containing a fairy tale, a fable, and three fables.

Some excellent selections from the Dhammapada were translated into English by Professor Samuel Beal in 1878, who also delivered a course of lectures on the Jātakas in 1885, and the whole works are easily accessible in Danish (Fausbøll, Copenhagen, 1861). The best Pāli grammar and reading book is that of Müller (London, 1885), the first work of its kind in English, which supersedes the much larger German work of Kuhn ("Beiträge zur Pāli Grammatik"). A Jātaka story is given as an exercise, with a translation and copious grammatical analyses.

PALICOU'REA, a genus of plants belonging to the order RUBIACEÆ. *Palicourea Moregraviæ* is a shrub from 5 to 6 feet high. It is a poisonous plant, used in Brazil to kill rats and mice. *Palicourea crocea* is a native of Porto Rico, Trinidad, Cuba, and Guadeloupe. According to Von Martius this species is emetic. *Palicourea diuretica*, *strepens*, *sonans*, and *longifolia* are among those reported to possess medicinal virtues. *Palicourea tinctoria* forms a fine red dye, much valued in Peru. All the species are of easy culture and propagation. They grow best in a mixture of loam, peat, and sand, and will strike root readily under a hand-glass. The genus is closely allied to Psychotria, differing in the corolla, which is distended or curved at the base, hairy within, and has five short, erect lobes.

PALIMPSEST (Gr. *palimpsestos*, from *palin*, again, and *psao*, to rub, wipe, or cleanse) is a term applied to parchment, papyrus, or other writing material from which the original text has been erased for the purpose of being written upon a second time. This process was effected by rubbing the original manuscript with pumice stone, or, if necessary, with a scraper, till the writing disappeared, after which the surface was smoothed down by a polishing tool.

When the rubbing process was not carefully performed the erasure was imperfect, so that it often happened in the case of re-written manuscripts that the original writing could be read without the slightest difficulty. This practice of preparing parchment and other writing materials for use a second time existed in the time of Cicero, Plutarch, and Catullus. Thus Cicero ("Ad Familiares," vii. 18) praises his friend Thebatus for having been so economical as to write on a palimpsest, but ironically adds that he would like to know what writing was of less importance than the letter which he had sent. Not only did this practice exist among the Greeks and Romans, but also among the Egyptians. It was not, however, till the ninth or tenth century that it became general among the Greeks and Romans, and in the eleventh century it seems to have reached its height. Under the early emperors the intercourse with Egypt and the East secured a cheap supply of papyrus, which rendered it unnecessary to make use of palimpsests, and in the fifth and sixth centuries the tax on papyrus was abolished. But when, through the Mohammedan conquest of Egypt, the supply of papyrus was cut off from Western Europe the use of palimpsests revived. It has generally been supposed that this practice of mediæval writers was the cause of a great sacrifice of ancient manuscripts, and that the hostility of the monks and clergy to classical literature induced them to make use of classical manuscripts for the purpose of writing their own services. Such, however, can hardly be the case, as all the palimpsest manuscripts hitherto discovered are in a fragmentary and mutilated condition. Fortunately, however, some of the fragments, especially those of biblical MSS., possess great importance. It often happens that the reading they give of a single verse settles a long disputed text. The value of the manuscript is in proportion to the clearness of the original writing. The new writing appears in various forms above the old. Sometimes the modern letters are much larger, in other specimens they are transverse, and in some the old page is turned upside down. In some cases the page is doubled, or divided into columns. The most difficult case for the decipherer is, when the new letters are of a size with the old, and are written along the same lines as those of the original manuscript.

Montfaucon was the first who suggested the possibility of extending our store of ancient literature by an examination of these manuscripts, but the idea was not turned to practical account till about the end of the eighteenth century. By far the greatest discoveries in palimpsest literature have been made by Cardinal Mai. He began his researches by publishing certain hitherto unedited fragments of some of Cicero's orations—viz. Flaccus, Tullius, and Scæurus. Shortly afterwards he published a second series, containing various fragments of three other orations of Cicero. Year after year he continued his explorations, and produced many valuable and important additions to this kind of literature. After him may be mentioned the names of Tischendorf, Barret, Bruns, Niebuhr, Cureton, Pertz, Blume, and Gaupp.

The following are the most important palimpsest publications which have hitherto appeared:—

I. *Biblical Palimpsests*.—The first MS. under this head of which any important use has been made appears to have been the Codex Ephremi, or Codex Regius of Paris. The next discovery made was the long-lost work of Ulphilas. It was found in the university library of Upsal, and is known by the name of Codex Argenteus, from being written chiefly in letters of silver. Besides these, we have "Fragments of the Gospel of St. Matthew," "Fragmenta Sacra Palimpsesta," "Fragmenta Evangelii Lucae et Libri Genesis," containing various fragments of Old and New Testament history. The greatest discoveries in biblical literature have been made by Dr. Tischendorf, whose success in deciphering the before-mentioned Codex

Ephremi in 1841–42, after many portions of it had defied the utmost skill of several eminent scholars, was of the most remarkable kind. Under this head may be mentioned some Greek liturgical fragments edited by F. J. Mone, from a palimpsest discovered at Carlsruhe, and a valuable manuscript of the Gospel of St. Luke, originally written in the sixth century, but afterwards in the ninth or tenth century written over again in Syriac.

II. *Palimpsests of Profane Literature*.—These consist of large fragments of lost Greek and Roman classics, of the text, and commentaries on the text, of the Roman law. The first palimpsest editor of this kind of literature was Dr. Paul Bruns, who discovered at Rome a palimpsest containing a fragment of the ninety-first book of Livy, which was published at Hamburg in 1773. In the British Museum is a palimpsest of the Iliad of Homer, amounting to about 4000 lines, written on vellum, in fine square Greek uncials, with accents and breathings. Its date is not later than the sixth century, and is therefore of greater antiquity than any of the known manuscripts of the Iliad. The uppermost text is Syriac, supposed to be of the ninth century. But a larger and more valuable contribution was made by Mai in giving to the world large extracts from various Greek writers. Of the Latin classics, the most important palimpsest discovered is the "De Republica" of Cicero. The exterior writing was a commentary of St. Augustine on the Psalms. This parchment was written in a clear and plain style, so that all its pages were deciphered with little difficulty. The blanks which it contained were filled up, as far as possible, from the various fragments preserved by Sigonius and other critics. Mai next published some important extracts relating to Roman law; and similar investigations were prosecuted by Niebuhr, who recovered from a palimpsest in the library of the chapter of Verona a fragment of the "Institutes" of the Roman jurist Gaius. Among the latest discoveries are portions of the first, eleventh, twelfth, thirteenth, and fifteenth books of Pliny, which were found by Dr. Friedegar Mone in a Benedictine monastery in Carinthia in 1834; and fragments of the history of Gaius Gracchus Licinianus—an author who flourished about the beginning of the Christian era—from a Syriac palimpsest. (See Dr. F. Mone's "De Libris Palimpsestis tam Latinis quam Græcis," Carlsruhe, 1855.)

PALINDROME (Gr. *palindromos*, running back again), a verse or line which reads the same either backwards or forwards, as in the well-known jest where Adam introduces himself to Eve in words few but fit—

"Madam, I'm Adam;"

or the motto—

"Ablata at alba"
(Retired but pure);

and in the Latin verse put into the devil's mouth—

"Signa te, signa, temere me tangis et angis."

PALINGENES'IA (Gr. *palin*, again, and *genesis*, birth), a term that seems to have been introduced by the Stoics, who employed it to signify the act of the Demiurgus or Creator, inasmuch as he, having absorbed all life and nature into himself, reproduced it in a new creation. Theologically, it is applied either to the resurrection of the body, or the restoration of the world hereafter to its primeval purity. In a word, it implies "regeneration," and thus, in science, it is sometimes used to designate that curious metamorphosis which the caterpillar undergoes when it is changed into a butterfly.

PALINURUS, a name sometimes figuratively given to a pilot, in memory of that pilot of Æneus who fell into the sea off the west coast of Lucania, and who, though he escaped to shore, was murdered by the natives. Cape Palinurus (now Palinuro) was named after him, so said the ancients; but one may suspect that the legend quite as probably arose from the name of the cape.

PALISANDER WOOD, a name applied to the Continent to rosewood. By some of the French cabinetmakers the term *bois de Palisandre* is also given to other fancy woods, such as violet-wood and striped ebony.

PALISSY, BERNARD, immortally famous as *Palissy the Potter*, was born about 1510 at Chapelle Biron, in Perigord, or according to other accounts, in the diocese of Agen. Bred as a painter on glass, and afterwards apprenticed to a land surveyor, he acquired some degree of skill in handling colours, as well as a dim knowledge of the rudiments of art, which enabled him to practise occasionally as a portrait painter. By degrees he became widely known from the excellence of his designs on glass. Commissions flowed in from every quarter, and in the journeys which their execution necessitated, his eager intellect was always on the quest for knowledge, which a capacious memory enabled him to retain. He especially devoted his attention to chemical subjects, and sedulously investigated the qualities and properties of the various kinds of earthenware.

About 1538 he married, and quietly settled down in the romantic city of Saintes, endeavouring to provide for the wants of a rapidly increasing family by practising in turns as a glass painter, a portrait painter, and a land surveyor. He was all things in the course of one revolving moon, but with little beneficial result to his wife and children. While perplexed and anxious as to their and his future, he was shown a richly enamelled vase of Italian manufacture, the handiwork of one of the Della Robbias. It immediately occurred to Palissy that if he could discover the secret of this new art of enamelling, which was wholly unknown in France, he might recuperate his fortunes with astonishing facility. "Regardless," he says, "of the fact that I had no knowledge of elays, I began to seek for the enamels as a man gropes in the dark. I reflected that God had gifted me with some knowledge of drawing, and I took courage in my heart and besought him to give me wisdom and skill."

The records of human energy and perseverance present few finer studies or more impressive illustrations than Palissy's unresting labour in pursuit of the enameller's art. His resources were scanty at the outset, and were soon exhausted in his numerous experiments. His first aim was to discover the white enamel, and he had to learn in what manner the earthenware should be combined and prepared so as to offer an equal resistance to the action of the intense heat in which alone the enamel will fuse. Day after day he tried, but tried in vain; occupying his spare hours in portrait painting, that he might secure some subsistence for his family. His wife, however, grew pale with want; his children sickened: from night to morning, and morning to night, the loud cry rang in his ears, "Bread, more bread!" Still he persevered. He was gifted with that unconquerable tenacity which never believes in a failure, and when one mixture of ingredients proved unsuccessful he essayed another. All the work was done by his own hands. He fetched the water, he mingled the elays, he got and the stone, he fed the furnace, and when, at last, his supply of fuel was exhausted, broke up and burnt the fences of his garden, his furniture, even the flooring of his house, to keep alive the insatiable fire. It is sad to remember that much of this suffering was caused by Palissy's ignorance of the fact that the process of making the white enamel was known to every potter in North Italy, but it is pleasant to record that his labour did not go unrewarded. Eventually he discovered the great secret, and found himself in possession of a composition of great plasticity, thoroughly manageable in the furnace. The bowls, vases, and other articles which he now produced he enriched with designs of reptiles, fishes, insects, shells, plants, fossils, for the most part moulded from the actual objects, and Palissy's pottery soon found its way to the cabinets of the wealthy. The Duke of Montmorency patronized him, and Charles IX. created him "King's Potter."

The last years of his life were clouded by religious persecution. During his period of struggle he had embraced the tenets of the Huguenots. The priests could not forgive the heretic for the sake of the artist. He was arrested in 1558, and thrown into prison at Bordeaux. The royal influence, however, effected his release. He removed to Paris in 1563, and was allowed to establish his furnace within the precincts of the Tuileries. His life was now cheered by a bright gleam of sunshine, and even through all the horrors of St. Bartholomew he passed unmolested and unscathed. His lectures on the natural sciences were attended by the leading *savants* and most fashionable courtiers of Paris. But in 1585 religious bigotry once more pounced upon its victim: he was arrested on the charge of heresy, and flung into the Bastille. Here he was visited by Henry III., who implored him to abandon his creed, as otherwise he was powerless to save him. "Sire," replied the enthusiast, "those who compel you, a king, can never compel me, a subject, because I know how to die."

He remained a prisoner in the Bastille until death released him from his bonds in 1590, when he was about eighty years old. A complete edition of his works was published in 1844 by Mous. P. A. Cap; and an admirable biography, embodying much original research, by Mr. Henry Morley, in 1852. The Palissy ware now commands an almost fabulous price. The Louvre contains a fine collection, and some good specimens are exhibited at the South Kensington Museum.

PALIURUS, a genus of plants belonging to the order RHAMNACEÆ. *Paliurus aculeatus* (Christ's thorn) is a very common plant in Palestine, and on the borders of the Mediterranean Sea. The fruit has a very singular appearance, resembling a head with a broad-brimmed hat on. At the base of each leaf there is a pair of short, stiff, curved spines. In the districts where it grows there is a tradition that this is the plant from which the crown of thorns was made which was placed on the head of our Saviour. This species of *Paliurus* is one of the most common thorns in the hedges of Asia, and its flexible spiny branches form an impassable kind of fence.

PALL MALL, a ball game, now obsolete, the ancestor of the modern croquet, wherein a pall or *palle* (Italian for ball) of iron or hard wood was struck through an iron ring with a mallet. The avenue by St. James' Park, where the game was played, has given its name to the street of clubs which now fills the site.

PALLADIO, ANDREA, the celebrated architect of the classical Renaissance, was born at Vicenza, in the Venetian territory, 30th November, 1518. Of his family, his early youth, and his first studies, scarcely anything certain is now known. It appears that he went three times to Rome, and returned from the last of these journeys in 1547, when he was in his twenty-ninth year, and settled at Vicenza. The first work of any importance entirely designed by himself was the Basilica or Palazzo della Ragione at Vicenza, a large ancient Gothic structure, the exterior of which he entirely remodelled. He surrounded it with noble arcades, two storeys high, rich, yet vigorous, which ornament the vast structure, the roof of which is seen rising behind them, without overpowering it. So great was the reputation he at once acquired that he was shortly after summoned to Rome by Paul III., who wished to consult him respecting the works then in progress at St. Peter's. He accordingly visited that city for the fourth time, but Paul died before he arrived. On his return he seems to have been overwhelmed with commissions, almost every one in Vicenza and its neighbourhood who could afford to build employing him to design a mansion or villa, of which class of subjects the majority of his works consist. The reputation acquired by these and similar works led to Palladio's being invited to Venice. He was at first employed upon some alterations at the convent Della

Carità, consisting of a Corinthian atrium and a cloister beyond it. Two churches, afterwards erected by him in the same city, afforded him an opportunity of displaying his talents in buildings of that class. The first of them, San Giorgio Maggiore, was begun in 1556, though the façade was not erected till 1610. The still more celebrated church called Il Redentore was begun in 1578, about two years before the architect's death. One of his last works, if not his very latest, was the Teatro Olimpico at Vicenza, which he did not live to complete. He died 6th August, 1580, and that structure was not entirely finished till 1583. Palladio wrote a work on the antiquities of Rome, "L'Antichità di Roma" (Rome, 1554); but the work by which he is most generally known is his work on architecture, "L'Architettura" (Venice, 1570, folio; best edition, Vicenza, 1776-83, four vols. folio). A very characteristic device of Palladio is the including two storeys of the building under one order or storey of architectural treatment. He is interesting to us from the madness of imitation of the Palladian style which seized upon England under the Stuarts, and for a long time afterwards, forcing upon England a style suited especially to Italy, a folly which has ruined our architecture long enough, and from which we are just awakening.

PALLADION (Lat. *Palladium*), a wooden statue of Pallas as a robed figure, 3 cubits high, holding in the left hand the distaff, and in the right hand the spear, which the old myth asserts to have fallen from the skies as a sign to Ilus, the founder of Troy or Ilium, that the protection of Zeus would be vouchsafed to him. The safety of the city depending on its preservation, Odysseus and Diomedes, the Greek leaders, contrived to steal it. But another tradition represents that it was a copy, and that the real palladium was conveyed from Troy to Italy by Æneas, and afterwards preserved in the temple of Vesta at Rome. This twofold tradition was merely an attempt to explain the existence of two images. Argos and Athens claimed both to possess the genuine image, and indeed Athens had two palladia. Rome, Lavinium, Luceria, and Siris in Italy all had what they asserted to be the palladium of Troy. Figuratively, it is now used to designate any particular law, right, or privilege with which the liberty and welfare of a nation are intimately associated.

PALLADIUM, a metal discovered by Dr. Wollaston in 1803. It is sometimes found native, quite pure in grains, and mixed with platinum. It is often found in ores of platinum in Brazil, the Ural, and other districts, and occasionally in auriferous sand, and in ores of gold and silver. It is usually obtained from the cyanide by ignition. In the native form it presents minute octahedrons. It is a white metal with silvery lustre, having a specific gravity of 11.8 when hammered or rolled. It is nearly as hard as platinum and almost as ductile, and it may be rolled into thin leaves. It has a lower melting point than platinum, and at the highest temperature of the oxyhydrogen furnace it sublimes in green vapour. The symbol is Pd; the atomic weight is 106. It is easily soluble in nitro-hydrochloric acid. It forms alloys with most of the metals. The alloy with gold is white and ductile; that with nickel is very malleable. None are of much practical importance. Palladium is used in making small balance weights, and instead of silver for scales of astronomical instruments, as it is not blackened by sulphuretted gases. The alloy with silver is used by dentists for stopping teeth. It is used also in solution for the estimation of iodine, with which it forms a very insoluble iodide; the reaction forms an extremely sensitive test for both elements. It is usually precipitated from solution as a cyanide by cyanide of mercury, which separates it from other metals, and from the cyanide the pure metal is obtained by ignition. Palladium has an extraordinary affinity

for hydrogen in the gaseous state; it appears to form an alloy, which has been called hydrogenium. [See HYDROGEN.] It forms two oxides—the protoxide or palladious oxide (PdO) and the dioxide or palladic oxide (PdO₂). The former only is known in the separate state; it is a black powder, which at a red heat is reduced to the metallic state. It forms two chlorides—the dichloride or palladious chloride (PdCl₂) and the tetrachloride or palladic chloride (PdCl₄). Both are yellow crystalline salts. The iodide (PdI₂) is a black insoluble powder, which gives off iodine on ignition. Palladium turns black with fumes of iodine, which does not affect platinum. Palladium forms a singular rose-coloured compound with ammonia, having the formula N₂H₆PdCl₂, which is probably ammonia-chloride of palladium, and from this a strong base is obtained called palladamine or oxide of palladammonium (N₂H₆PdO). This base forms a number of definite salts with acids.

PALLAH (*Aepyroceros melampus*) is a large ANTELOPE inhabiting South and South-eastern Africa. The pallah (or impalla) stands upwards of 3 feet high at the shoulder. The colour is dark red on the back, becoming lighter on the sides and white on the belly. The tail is about a foot long, white at the extremity, and marked by a dark brown streak down the middle. The horns, only present in the male, are 20 inches long, and ringed nearly to the tips. The accessory hoofs are wanting. The pallah is gregarious, collecting in herds of from twenty to thirty. The flesh is coarse, but palatable.

PALLAS is the name of one of the four principal planets of the crowd of asteroids revolving between the orbits of Mars and Jupiter, and was discovered by Dr. Olbers, of Bremen, 28th March, 1802. Herschel estimated its diameter at only 80 miles. Pallas has a certain hazy appearance, which gives rise to the assumption that it may have an atmosphere of considerable density. It is also thought to be proved that this planetoid upon its axis is like the planets. For the general characteristics of the group to which Pallas belongs, see ASTEROIDS.

Pallas has a year of 1686 days, and its distance from the sun is about 2½ times that of the earth.

PALLAS, PETER SIMON, an illustrious traveller and naturalist, was the son of a surgeon at Berlin, where he was born 22nd September, 1741. He was brought up to the medical profession, and instructed in the natural and medical sciences, in which he made rapid progress. He took his doctor's degree at Leyden, on which occasion he wrote an inaugural dissertation on intestinal worms. In 1763 he obtained his father's permission to settle at the Hague, where, in 1766, he published his "Elenchus Zoophytorum," a work which acquired him considerable reputation. The "Miscellanea Zoologica," which appeared the same year, further increased the fame of Pallas, and on the invitation of the Empress Catharine, he accepted the professorship of natural history in the Imperial Academy of Sciences, St. Petersburg, in 1767.

At the time of his arrival in Russia, an expedition, composed of a number of astronomers and other scientific men, was on the eve of setting out, by command of the empress, for the purpose of observing the transit of Venus, and of investigating the natural history and geography of Siberia and the other northern parts of the Russian Empire. Pallas gladly accepted an invitation to accompany them, and set off in June, 1768. The first summer was spent in traversing the plains of European Russia, and the winter was passed at Simbirsk, on the Volga. The next year the expedition visited the borders of Kalmuck Tartary, when Pallas carefully examined the shores of the Caspian Sea. They afterwards proceeded through Orenburg, and passed the next winter at Ufa. In 1770 Pallas crossed the Uralian Mountains to Ekaterinburg, and thence proceeded to Tobolsk, the capital of Siberia. The year following the expedition reached the Altai Mountains, across which Pallas pene-

trated to the frontiers of China, whence he retraced his steps, and slowly proceeded homewards, visiting Astrakhan and the neighbourhood of Mount Caucasus on the way back. In July, 1774, he reached St. Petersburg with a series of valuable collections which included all departments of natural history, while his written observations extended to every point of interest in the region traversed and its inhabitants.

The Empress Catharine decorated him with titles, and gave him several lucrative appointments. After remaining many years at St. Petersburg, quietly engaged in the pursuits of literature and science, in 1793 and 1794 he travelled through the southern provinces of Russia, and then settled in the Crimea, where he stayed for fifteen years, after which he sold his property and quitted Russia. Pallas died at Berlin, 7th September, 1811.

PALLAVICINO, SFORZA, son of the Marquis Alessandro Pallavicino, was born at Rome in 1607. He studied in the Roman College, and afterwards entered the order of the Jesuits. The work for which he is best known is the "History of the Council of Trent" ("Istoria del Concilio di Trento," three vols. 4to, Rome, 1664), written with a view of correcting and superseding the celebrated work of Paul Sarpi on the same subject. Pope Alexander VII. made Pallavicino a cardinal, and employed him in important affairs. He died in 1667.

PALLIUM or **PALL** (Gr. *himation*), a garment anciently worn by the Greeks, as the toga was by the Romans. It was a large piece of cloth, usually square, always at least rectangular, worn just as it came from the loom, except for any embroidery or fringe, &c., that might be added. It was wrapped round the body or was fastened gracefully on the right shoulder with a brooch, so that the right shoulder and arm were bare, and the left shoulder and arm protected by a sort of sleeve, or in any other way the bearer pleased. The ancient pallium was literally a blanket, and the Red Indian of to-day shows exactly the use that was anciently made of it. It served as a cloak by day and a wrap by night, and sometimes as a carpet of dignity. It was made as fine as silk for dandies, and as rough and hairy as a skin for common folk. It was the only garment of Diogenes and his brother Cynics. As to colour, it varied with the fancy of the owner, but striped blankets were always among the most favourite patterns.

In a modified and ornamental form it was used by the emperors of the Lower Empire, and in the fourth century was given by the Christian emperors to the prelates of the church, as a vestment of distinction and superiority. At the commencement of the thirteenth century, when papal ascendancy was at its zenith, and when the Holy See derived a large revenue from the sale of these pallia, some of the great sees being fined several thousand pounds sterling, Pope Gregory XI. decreed that an archbishop could not call a council, consecrate churches or bishops, or perform any archiepiscopal act, before he had received his pallium; and that before he could obtain this sacred vestment, he must apply in person or by proxy to the Pope for it, and take an oath of fidelity. It was also decreed that upon the translation of an archbishop he was not to carry away his pall, but to apply for a new one; and that his successor should make no use of the one left behind. On the archbishop's death his pallium was to be interred with him. All these regulations are still in force in the Roman Catholic Church.

The ecclesiastical pallium is made of white wool, in the form of a band 3 inches broad, upon which black crosses are embroidered. The wool of which it is made is grown by two lambs, blessed for the purpose in the Church of St. Agnes on that saint's day. It is worn round the neck of the archbishop, and has two pendants, one before and one behind, each a span long, and the ends ornamented with red crosses. Its use is supposed to symbolize the Good

Shepherd bearing the lost sheep on his shoulders. It is worn by the Pope at all times, but by archbishops only on great occasions. The bishops of the Eastern Church also wear a pall, called *amphokation*, which resembles the ancient pallium more nearly than that worn by Western metropolitans, approaching nearer to the shape of a cope.

In England the term pall is applied to the covering thrown over a coffin at a funeral.

PALM, PHILIP, a bookseller of Nuremberg, whose name has become historical from its connection with one of the Emperor Napoleon's darkest crimes. He was born at Schorndorf in 1766, and succeeded his father-in-law as a bookseller at Nuremberg. Early in 1806 he received, in the ordinary course of trade, and despatched to an agent at Augsburg, a political pamphlet, "Deutschland in seiner tiefsten Erniedrigung" (Germany in its Lowest Humiliation), which reflected severely on the French emperor's ambitious policy. Napoleon immediately ordered his arrest, though he was in no way amenable to French jurisdiction. He was accordingly dragged from his bed at midnight by a body of gendarmes, and hurried away to Brunau, where he was hastily tried by a court-martial composed of French colonels, condemned, and shot, sentence being passed and execution taking place on the same day (26th August). This cold-blooded and atrocious murder of a citizen of a neutral state caused a deep sensation in Germany, and tended to inflame the spirit of bitter hatred which eventually set all Europe in array against the imperial tyrant.

PALM SUGAR, a variety of cane-sugar obtained from various kinds of palm.

PALM SUNDAY (*Dominica Palmarum*, or *Dom. in Palmis*, or *Pascha Floridum*), the Sunday before Easter, so named because on that day boughs of palm trees used to be carried in procession, in imitation of those which the Jews strewed in our Saviour's way when he went up to Jerusalem. In the Roman Catholic Church, and also in the Greek Church, the ceremony of blessing branches of the palm tree, or of other trees substituted in those countries in which the palm cannot be procured, is still celebrated on Palm Sunday. At Rome, the procession of the palms, in which the Pope is carried, is one of the most striking of the holy week ceremonies. Palm Sunday still retains its name in the calendar of the Church of England, but the blessing and procession of palms was abolished in the reign of Edward VI.

PALMA, a fortified town of the Balearic Islands, the capital of Majorca, with a fine harbour, greatly improved since 1875, in the Bay of Palmas, on its south-west coast. It is beautifully situated on the bay, from which it rises in the form of an amphitheatre, surrounded by orange groves. It is inclosed by a wall flanked with bastions, and entered by eight gates, and consists generally of narrow, winding, and ill-paved streets; but it has several handsome squares, a large and massive Gothic cathedral, a Gothic exchange, adorned with fine sculptures; a town-hall, containing fine paintings and some early charts and rare manuscripts; governor's palace, several churches, one formerly a mosque, &c. The manufactures are woollen and silk stuffs, brandy, soap, and glass; shoes are extensively made and sent to the West Indies; and the trade which centres here from all parts of the island is considerable. Population, 58,224.

PALMA, one of the Canary Islands, situated 67 miles W.N.W. of Tenerife, is about 30 miles long from north to south, with a greatest breadth of about 20. The area is 718 square miles, and the population about 33,000. The mountain ridge runs from north to south, and contains many extinct craters of great height. The central crater, called Caldera, is surrounded by many lofty peaks, of which the Pico de los Muchachos and the Pico de la Cruz rise to the respective heights of 7631 and 7469 feet above the sea. The coasts and valleys are extremely fertile, produc-

ing much wine, fruits, and silk. There are forests in the island which yield good timber; the palm, sweet-hay, and myrtle abound; and in many places the *Euphorbia balsamifera* or *Canariensis* grows. Santa Cruz de las Palmas, the capital, is on the east coast; it and Tazacorte, on the west coast, are the chief ports. Some taffetas, stuffs, and ribbons are the only articles manufactured which are of any importance.

PALMA CHRISTI, a name applied to the CASTOR-OIL plant, or *Ricinus communis*.

PALMA VECCHIO (i.e. Palma the Elder) was the familiar sobriquet of Jacopo Palma, an eminent painter of the Venetian school, a contemporary and in his youth, before the rise to consummate excellence of that immortal painter, a worthy rival as a colourist of Titian himself. More than one work attributed to the more famous Giorgione is now with great reason suspected to be due to Palma's pencil.

There is another Venetian painter of this family of no great merit, called for distinction's sake Palma Giovane (Palma the Younger), born at Venice, 1544, and died there 1628. The masterpiece of this artist is St. Barbara, in the Church of St. Maria Formosa at Venice. Palma was born at Bergamo in 1480, and was still living at Venice in 1528. By some his death is set at that year, but others assert that he lived till 1574.

PALMAS, a town situated on the north-east coast of Gran Canaria, one of the Canary group, of which it was formerly the capital, in a plain on both sides of the Guinguada. It is regularly built, and has some fine fountains, squares, and promenades; a handsome Gothic cathedral, several monasteries and nunneries, a diocesan seminary, an academy of design, hospitals, &c. The manufactures consist of hats, woollens, leather, and earthenware. The fisheries are productive. A good many vessels are fitted out in the building yards, and a considerable trade is carried on, both with the West Indies and with Europe. Population, about 18,000.

PALMEÆ. See **PALMS**.

PALMELLEÆ is a group of Algae, several members of which are familiar from their mode of occurrence, like blood-stains at the base of walls. Red Snow (*Protococcus nivalis*) is one of the group. Each of these Algae is a single microscopic cell, which may remain free or unite with several others. See **ALGÆ** for further information.

PALMER, EDWARD HENRY, M.A., a distinguished Orientalist, was born at Cambridge, where his father kept a private school, 7th August, 1840. He lost both parents while he was yet a child, and he was brought up and educated under the care of an aunt. At school he acquired Latin and Greek, and outside school he learned Romany, the language of the Gypsies, gaining at the same time considerable insight into Gypsy life. At the age of sixteen he became a clerk in the city of London, and in his spare time he learned French and Italian, chiefly by frequenting the cafés, clubs, and other places where foreigners resorted. Finding a mercantile life uncongenial to his tastes he entered at St. John's College, Cambridge, at the age of twenty-three, where he graduated in the year 1867, taking a third class in classical honours. For a few years previous to this event he had been earnestly devoting himself to the study of Oriental languages, and in 1867 he was elected a fellow of St. John's on the ground of his attainments in Persian and Hindustani. He accompanied the Sinai Survey Expedition in 1868-69 to investigate the nomenclature, traditions, and antiquities of Arabia Petraea, and followed up this work in 1870 by exploring the desert of the Tih, in company with Mr. C. F. Tyrwhitt for the committee of the Palestine Exploration Fund. The two friends walked the whole way, having neither escort nor dragoman, trusting entirely and successfully to Palmer's wonderful power of managing the Arabs. The results of

this journey were published in a treatise on "The Negeb, or South Country of Scripture, and the Desert of El Tih," and a personal narrative entitled "The Desert of the Exodus," both published in 1871. In 1870 he took the degree of M.A., and in 1871 he was appointed to the Lord Almoner's professorship of Arabic at Cambridge. He then married and settled down to teaching and literary work, but owing to pecuniary difficulties, caused by the protracted illness of his wife, who died in 1878, he was obliged to use his pen for work that hardly did justice to his great talents, and ultimately most of his energies became absorbed in journalism. Among the more important works produced during this period of his life may be mentioned, a revision of Henry Martyn's translation of the New Testament into Persian for the Bible Society; "Poems of Behâ-ud-Din" (Arabic and English, two vols., 1876-77); "Arabic Grammar" (1877); "Persian Dictionary" (1876); a translation of the Qu'ran (Korân) for the "Sacred Books of the East" (1880); a "Life of the Caliph Haroun al Raschid" (1880); and an "English and Persian Dictionary" (published in 1883). He also published numerous translations of Arabic and Persian poems; translated Moore's "Paradise and the Peri" into Arabic, wrote in conjunction with Mr. Walter Besant a "History of Jerusalem," and contributed largely to the reviews and magazines. On the outbreak of the nationalist revolution in Egypt, Palmer was sent on a mission by the British government to the Arab tribes in the Desert and Peninsula of Sinai, and he succeeded in making such terms with them as to secure the Suez Canal from interruption and keep the Arabs from joining their forces with those under Arabi, thus securing the British army from molestation from the rear of its position on the canal. He was then sent on a second expedition from Suez with Captain Gill and Lieutenant Charrington to purchase camels, and perform certain secret services for the British government, and while on this journey he was mysteriously attacked and murdered with his two companions in August, 1882. Their remains were recovered after the war, brought to England, and interred in St. Paul's Cathedral. A biography of Professor Palmer by his friend Mr. Walter Besant was published in 1885.

PALMER, SAMUEL (1805-81), a water-colour painter of wonderfully fine and poetical imaginative power, who also painted with great success, though not with such peculiar excellence, in oils. He was a devout admirer of Blake, whose mysticism and romance pervade much of his work. Palmer's colour even in the delicate medium of water-colour was brilliant and rich. His imaginative landscapes under the glow of sunset or of autumn hues are works of unique power. He married a daughter of the eminent artist John Linnell.

PALMERS (Lat. *palmifer*, a palm-bearer), a class of pilgrims who had accomplished the journey to Jerusalem, and were so called because they carried in their hands a branch of the Eastern palm in commemoration of their fulfilled vow. The palms were afterwards offered to the church, placed upon the altar, and borne in solemn procession on Palm Sunday.

PALMERSTON, VISCOUNT, HENRY JOHN TEMPLE, statesman, and twice prime minister of England, was born at Broadlands, Hampshire, the ancestral seat of his family, on the 20th October, 1781. He was a lineal descendant of Anthony Temple, secretary successively to Sir Philip Sidney and to the Earl of Essex, who founded the Irish branch of the Temple family. His father, the second Viscount Palmerston, was made a commissioner of the admiralty in 1766, and was well known in the literary and artistic, as well as fashionable, circles of London. Lord Palmerston was educated first at Harrow, from which in his sixteenth year he went to Edinburgh, residing with Dugald Stewart for three sessions, and in 1803 he entered St. John's, Cambridge. In 1802, by the death of his father,

he had succeeded to the Irish peerage, and by the interest of his guardians he was introduced at a very early age into political and official life. After two unsuccessful attempts he entered Parliament for a pocket-borough, Newtown, Isle of Wight, in June, 1807. His official career commenced the same year when the Duke of Portland made him one of the junior lords of the admiralty, and he delivered his maiden speech, 3rd February, 1808, in defence of the expedition against Copenhagen. This speech created such a favourable impression that in 1809 he was offered the post of chancellor of the exchequer by Percival, but prudently declined it, becoming instead secretary at war without a seat in the cabinet. In this position he remained apparently without ambition for twenty years, being chiefly known during this time as a man of fashion; but when the Canning administration was formed he combined with his old office a seat in the cabinet, and retained both in the succeeding "transition ministry" of Lord Goderich, and in that of the Duke of Wellington. He was among the Canningites who retired from the Wellington ministry when the duke forced on the resignation of Mr. Huskisson, and from that event dates his rise in political importance. He spoke elaborately and forcibly in the final discussions on Catholic emancipation, and he now began to distinguish himself as the advocate of a liberal foreign policy. With the accession of Lord Grey and the Whigs to power in November, 1830, Lord Palmerston received the seals of the foreign office, and retained them till the formation of Sir Robert Peel's ministry in November, 1834. It was in the foreign office that Palmerston earned his peculiar fame, and in which he most signally displayed his brilliant abilities. He was animated by the conviction that Great Britain stood first among the nations of the world; he displayed an unprecedented vigour in upholding the rights and supporting the claims of British subjects abroad; and whatever may be thought of the results of his policy, there can be no question that it was steadily directed towards the extension of British influence.

When he entered upon his office as secretary for foreign affairs some important questions were pressing for solution, and in dealing with them he displayed much spirit and resolution. He consolidated the alliance with France, and in concert with Louis Philippe he established the independence of Belgium and placed upon its throne a ruler friendly to both countries. With the same aid he negotiated the quadruple alliance (22nd April, 1834) of England, France, Spain, and Portugal, which gave a deathblow to the designs of the reactionary Carlists and Miguelites of the Peninsula. On the fall of Sir Robert Peel's short ministry, Lord Palmerston returned to the foreign office and retained his position until Sir Robert's reversion to power, in September, 1841. The chief of his achievements during his second occupation of the foreign office was the effecting a defeat of the French Eastern policy, which aimed at the dismemberment of Turkey by depriving her of Syria and Egypt. In 1810 he secured the assent of Russia, Prussia, Austria, Turkey, and Great Britain to a convention which dictated terms to Mehmet Ali and left France isolated in Europe. Action followed quickly on negotiation, and after the bombardment of Beyrout, the fall of Acre, and the collapse of the power of Mehmet Ali, Lord Palmerston came to be regarded as one of the foremost statesmen of Europe. At home, however, he was less successful, and in 1841, along with the rest of the Whigs, he went out of office on the question of free trade, and remained in opposition for five years. In July, 1846, after the repeal of the corn laws and the overthrow of Sir Robert Peel's second and final ministry, the Whigs returned to power, and with them Lord Palmerston to the foreign office. The trickery of Louis Philippe and his minister Guizot had destroyed the *entente cordiale* between France and Great Britain, and Palmerston had to oppose, and did

oppose successfully, the policy not only of Austria, but of France and Switzerland, when the Catholic cantons revolted against the Federal Diet. During the revolutionary movements of 1848-49, while maintaining on the whole a policy of non-interference and non-intervention, he furthered to the best of his ability the cause of Italian independence; and while he did not support Hungary in her efforts to throw off the Austrian yoke, he supported Turkey in her refusal to surrender the Hungarian fugitives to the tender mercies of Austria. He frankly recognized the French Republic, and lent the support of England to a pacific settlement of the Danish difficulties. At the same time he awakened a feeling of suspicion or resentment on the part of nearly all the great powers of Europe; and when in 1850 he brought strong pressure to bear upon Greece, on account of the affair of Don Pacifico, even the ill-will of France was aroused. The strength of his parliamentary position, however, was shown in June, 1850, when Sir Robert Peel, with his personal followers, the Conservatives under Mr. Disraeli, and Mr. Hume with the Manchester party, coalesced to oppose a vote of censure moved against Lord Palmerston (who had just been formally censured by the House of Peers), and defeated it by a majority of forty-six. Eighteen months after this triumph, however, Palmerston, who had presumed too much upon his victory, gave great offence to his colleagues and to the court, by recognizing upon his own account the *coup d'état* of Louis Napoleon, and he was in consequence compelled to resign. He speedily avenged himself by overthrowing Lord Russell's administration on a question connected with the militia, but he never again returned to the foreign office. On the formation of the Aberdeen cabinet in 1853, he accepted the position of home secretary, and in this new position displayed his customary energy and good sense. The breakdown of our military system in the Crimean War and the calamities which ensued, led to his accession to the premiership in 1856 with the general consent of the nation. He conducted the war to an honourable close with the approval of the country; and when in March, 1857, he was defeated by a hostile combination of parties on the question of the Chinese War, he dissolved Parliament, and his appeal to the nation was answered by the overwhelming defeat of his opponents. He was defeated by another coalition in February, 1858, on the introduction of a conspiracy bill, produced by the attempt of Orsini on the life of the Emperor Napoleon III.; but the ministry formed under Lord Derby only lasted a year, and in June, 1859, Palmerston returned to power, and introduced into his government the more prominent of his former opponents, Lord John Russell becoming foreign secretary, Mr. Gladstone chancellor of the exchequer, and Mr. Milner Gibson president of the Board of Trade. He unsuccessfully opposed the French project for cutting a navigable canal through the isthmus of Suez, from the belief that it would lead to complications between England and France; and during the Civil War in America, while he maintained a strict neutrality, his own feelings were in favour of the Southern States, one circumstance among many others which served to awaken a feeling of bitterness in the North which it took many years to efface. When the Germanic Confederation made its unprovoked attack upon Denmark in 1864, he endeavoured to prevent the annexation of the duchies of Schleswig and Holstein; but Russia and France stood aloof, and he was unable to effect anything. After the defeat of Denmark he favoured the Prussian design of incorporating the duchies, and in a remarkable letter written in September, 1865, to Earl Russell, he pointed out the need of a strong and united Germany to act as a check upon the aggressive Russian Empire. Although he had reached an age far exceeding the average span of human life, he displayed no falling off in energy, elasticity of mind, or clearness of judgment, and every Englishman felt proud of the chief who stood

forward as so conspicuous a type of the best qualities of the race, when, full of years and honours, he expired after a very short illness at Brocket Hall, 18th October, 1865. His remains were interred in Westminster Abbey.

Although it cannot be denied that in his management of the foreign affairs of Great Britain he was at times somewhat overbearing and aggressive, it is certain that he acted throughout from patriotic and public motives. His sympathies, as a rule, were displayed in favour of freedom and liberalism, and in everything that he did he was animated by a profound conviction of the dignity and power of the British Empire.

Lord Palmerston married, in 1839, the widow of the fifth Earl Cowper, an accomplished lady who devoted herself with enthusiasm to his interests, and who sustained with great ability the position of one of the leaders of European society.

See "Life of Viscount Palmerston, with selections from his Diaries and Correspondence," commenced by Sir H. B. Lytton (Lord Dalling), and concluded, after Lord Dalling's death, by the Hon. Evelyn Ashley, five vols., 1870-76.

PALMER-WORMS are the hairy caterpillars of a species of nocturnal moths, which anglers approve of as a good bait in trout-fishing.

PALMETTO (*Sabal Palmetto*), a species of palm which flourishes in the littoral districts of North America as far north as lat. 35°. It attains a height of 40 feet, and is crested with a tuft of fan-shaped and plaited leaves, varying from 1 to 5 feet in length and breadth. The leaves are made into hats; the terminable bud or cabbage is used for food, but the fruit is uneatable. The wood of the trunks is very tough and durable. It is largely used for wharves. During the American War of Independence stockades were made of the palmetto in the Southern States, and proved so serviceable that the plant was introduced into the arms of South Carolina, and during the Civil War the Palmetto Flag became a national emblem.

PALMISTRY (Lat. *palma*, the hand), the science of divining the events of the future by an inspection of the lines and marks on the palm and fingers of the human hand. It is now chiefly practised by Gypsies and pseudo-Gypsies, who profess to see a "line of life," a "line of marriage," a "line of death," and other mysterious signs, invisible to ordinary eyes, except as the mere wrinkles of the skin caused by closing the hand, and differing therefore in each individual, inasmuch as the hands also differ. The whole pretended science rests upon this easily ascertained diversity, which is absurdly supposed to correspond with the diverse fates of men.

PALMITIC or **CETYLIC ACID**. This acid is largely distributed in animal and vegetable fats. It is found in spermaceti, in Japan wax, in beeswax, in which it exists as palmitate of melissyl; it is abundant in palm oil in combination with glycerin, also in butter, suet, and many fats and oils. It is a colourless crystalline fatty acid, insoluble in water, but very soluble in boiling alcohol or ether, from which it crystallizes in small needles. It melts at 62° C. (143° Fahr.), and crystallizes again on cooling. The formula is $C_{16}H_{32}O_2$. It forms a number of salts called palmitates, and having the general formula $C_{16}H_{31}MO_2$, of which only those of potassium and sodium are soaps soluble in water. It forms three compounds with glycerin, called palmitates of glyceryl, or palmitins: Monopalmitin ($C_{51}H_{98}O_6$), dipalmitin ($C_{50}H_{96}O_6$), and tripalmitin ($C_{51}H_{96}O_6$). All are fats, and are found in palm oil, Japan wax, human fat, and coffee berries. Palmitic acid, distilled with lime, yields palmitone ($C_{21}H_{42}O$), a crystalline body soluble in alcohol, and melting at 84° C. (183° Fahr.)

PALMS are woody plants, usually trees, with simple stems, inhabiting the warmer parts of the world, and especially tropical countries. They constitute an order of **MONOCOTYLEDONS**, most important on account of the

many uses to which the species or their products are applied, but in reality nearly allied to the **JUNCACEÆ** or rushes of northern countries.

Although palms are found throughout the tropics, and a few species even extend into the warmer parts of the temperate regions, they are yet so much more abundant and varied within the limits of the tropics, that they may be considered as among the most characteristic forms of vegetation of equatorial zones. They are, however, by no means generally present, and we may pass through miles of forest without even seeing a palm. In other parts they abound; either forming a lower growth in the lofty forests, or in swamps and on hill-sides sometimes rising up above the other trees. On river-banks they are especially conspicuous and elegant, bending gracefully over the stream, their fine foliage waving in the breeze, and their stems often draped with hanging creepers.

The chief feature of the palm tribe consists in the cylindrical trunk crowned by a mass of large and somewhat rigid leaves. They vary in height from a few feet to that of the loftiest forest trees. Some are stemless, consisting only of a spreading crown of large pinnate leaves, but the great majority have a trunk slender in proportion to its height. Some of the smaller species have stems no thicker than a lead pencil and 4 or 5 feet high, while the great *Mauritia* of the Amazon has a trunk fully 2 feet in diameter and more than 100 feet high. Some species probably reach a height of 200 feet, for Humboldt states that in South America he measured a palm which was 192 English feet high. The leaves of palms are often of immense size. Those of the *Manicaria saccifera* of Para are 30 feet long and 4 or 5 feet wide, and are not pinnate but entire, and very rigid. Some of the pinnate leaves are much larger, those of the *Raphia tadigera* and *Maximiliana regia* being both sometimes more than 50 feet long. The fan-shaped leaves of other species are 10 or 12 feet in diameter. The trunks of palms are sometimes smooth and more or less regularly ringed, but they are frequently armed with dense prickles, which are sometimes 8 inches long. In some species the leaves fall to the ground as they decay, leaving a clean scar; but in most cases they are persistent, rotting slowly away, and leaving a mass of fibrous stumps attached to the upper part of the stem. This rotten mass forms an excellent soil for ferns, orchids, and other semi-parasitical plants, which form an attractive feature on what would otherwise be an unsightly object. The sheathing margins of the leaves often break up into a fibrous material, sometimes resembling a coarse cloth, and in other cases more like horsehair. The flowers are not individually large, but form large spikes or racemes, and the fruits are often beautifully scaled, and hang in huge bunches, which are sometimes more than a load for a strong man. The climbing palms are very remarkable, their tough, slender, prickly stems mounting up by means of the hooked midribs of the leaves to the tops of the loftiest forest-trees, above which they send up an elegant spike of foliage and flowers. The most important are the American *Desmoncus* and the Eastern *Calamus*, the latter being the well-known rattan or cane of which the chair-seats are made, from the Malay name *ratang*.

To the natives of the equatorial zone the uses of palms are both great and various. The fruits of several species—more especially the coco-nut of the East and the peach-nut (*Guilelma speciosa*) of America—furnish abundance of wholesome food, and the whole of the trunk of the sago-palm is converted into an edible starch (our sago). Many other palm fruits yield a thin pulp, too small in quantity to be directly eaten, but which, when rubbed off and mixed with a proper quantity of water, forms an exceedingly nutritious and agreeable article of food. The most celebrated of these is the assai of the Amazon, made from the fruit of the *Enterpe oleracea*, and which, as a

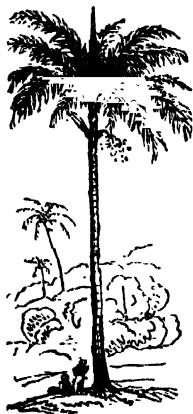
refreshing, nourishing, and slightly stimulating beverage for a tropical country, takes the place of our chocolate and coffee. A number of other palms yield a similar product, and many that are not eaten by man are greedily devoured by a variety of animals, so that the amount of food produced by this tribe of plants is much larger than is generally supposed.

"The sap which pours out of the cut flower-stalk of several species of palm, when slightly fermented, forms



Wax Palm.

palm-wine or toddy, a very agreeable drink; and when mixed with various bitter herbs or roots which check fermentation a fair imitation of beer is produced. If the same fluid is at once boiled and evaporated it produces a quantity of excellent sugar. The *Arenga saccharifera*, or sugar-palm of the Malay countries, is perhaps the most productive of sugar. A single tree will continue to pour out several quarts of sap daily for weeks together, and



Cabbage Palm.



Palm-oil Tree.

where the trees are abundant this forms the chief drink and most esteemed luxury of the natives.

"Other articles of food produced from palms are, cooking oil from the cocoa-nut, salt from the fruit of a South American palm (*Leopoldinia major*), while the terminal

bud or 'cabbage' of many species is an excellent and nutritious vegetable; so that palms supply bread, oil, sugar, salt, fruit, and vegetables. Oils for various purposes are made from several distinct palms, while wax is secreted from the leaves of some South American species; the resin called dragon's blood is the product of one of the rattan palms; while the fruit of the areca palm is the betel-nut, so universally chewed by the Malays as a gentle stimulant, and which is their substitute for the opium of the Chinese, the tobacco of Europeans, and the cocoa-leaf of South America.

"For thatching the leaves of the palms are invaluable, and are universally used wherever they are abundant; and the petioles or leaf-stalks, often 15 or 20 feet long, are used as rafters, or when fastened together with pegs form doors, shutters, partitions, or even the walls of entire houses. They are wonderfully light and strong, being formed of a dense pith covered with a hard rind or bark, and when split up and pegged together serve to make many kinds of boxes, which, when covered with broad leaves of a species of screw-pine, and painted or stained of various colours, are very strong and serviceable as well as very ornamental. Ropes and cables are woven from the black fibrous matter that fringes the leaves of the sugar palm and some other species, while fine string of excellent quality, used even for bow-strings, fishing-lines, and hammocks, is made of fibres obtained from the unopened leaves of some American species.

"The fibrous sheath at the base of the leaves of the cocoa-nut palm is so compact and cloth-like, that it is used for a variety of purposes, as for strainers, for wrappers, and it makes very good hats. The great woody spathes of the larger palms serve as natural baskets, as cradles, or even as cooking vessels, in which water may be safely boiled. The trunks form excellent posts and fencing, and when split make good flooring. Some species are used for bows, others for blowpipes; the smaller species are sometimes used as needles, or to make fish-hooks, and the larger as arrows. To describe in detail all the uses to which palm-trees and their products are applied in various parts of the world might occupy a volume; but the preceding sketch will serve to give an idea of how important a part is filled by this noble family of plants, whether we regard them as a portion of the beautiful vegetation of the tropics, or in relation to the manners and customs, the lives and the well-being of the indigenous inhabitants." (Wallace, "Tropical Nature.")

Palms are found abundantly fossil in various Tertiary formations. There is a very fine specimen of the palm *Phœnicites* in the Natural History Museum, South Kensington, found in the cliffs at Bourne-mouth in beds of Middle Eocene age. A great number of palms are also found in the Lower Molasse of Switzerland, near Vevay, on the Lake of Geneva, e.g. *Sabal*, a palm now only found in North America, and *Phœnicites*. Another genus found in Switzerland in Miocene strata is *Manicaria*, now growing only in the Amazons.

The flowers of palms are sometimes unisexual; they have a double three-parted perianth, and are arranged along a stalk (the spadix) which is generally branched, and enclosed by a sheathing organ (the spathe). There are six stamens; a superior ovary of one to three carpels, which are free or adhere to one another; the ovules are solitary, rarely two. The fruit is berry-like. The seeds have a minute embryo in a large mass of albumen.

PALMYRA (Heb. *Tadmor*). Both these names are derived from the palm trees which once grew in the neighbourhood of this ancient city. Palmyra is situated in an oasis of the Syrian Desert, nearly halfway between the Orontes and the Euphrates, about 120 miles north-east from Damascus.

Palmyra is sheltered by hills to the west and north-west,

and supplied with wholesome water. It is on a line leading from the coast of Syria to the regions of Mesopotamia, Persia, and India, a circumstance which must have pointed it out to the caravans as a convenient halting-place in the desert. We read in the Second Book of Chronicles (viii. 4) that Solomon "built Tadmor in the wilderness, and all the store cities which he built in Hamath," but it is doubtful if Palmyra is the Tadmor alluded to. In the time of Pliny it was the intermediate emporium of the trade with the East, a city of merchants and factors, who traded with the Parthians on one hand and the Romans on the other. The produce of India found its way to the Roman world through Palmyra. It afterwards became allied to the empire as a free state, and was greatly favoured by Hadrian and the Antonines.

The most splendid period of the history of Palmyra was that which immediately preceded her fall. Valerian, emperor of Rome, having been made a prisoner by Sapor, king of Persia, Odenathus, a citizen of Palmyra, who had attained to the principal direction of her affairs, joined the Roman forces, and had a large share in avenging the insult offered to the majesty of Rome. He attacked the Persians, drove them beyond the Euphrates, penetrated as far as their capital city Ctesiphon, and captured the treasures and women of the great king. For these services the senate, with the approbation and applause of the Roman world, conferred on Odenathus the title of Augustus, and associated him in the empire with Gallienus. These honours, however, he enjoyed only for a brief period, being soon after (A.D. 263) assassinated by his nephew. The vacant throne was seized by his young, warlike, and beautiful widow, the famous Zenobia, who broke the alliance with the imbecile Gallienus, and assumed the title of Augusta, queen of the East.

Zenobia, who boasted of being the descendant of Cleopatra and the Ptolemies, sent, after the death of her husband, on pretence of this relationship, an army into Egypt, which she annexed to her dominions. But her troops were unequal to a contest with the disciplined legions of Aurelian. After being defeated in two great battles, Zenobia shut herself up in Palmyra. But seeing that it must fall into the hands of Aurelian, she attempted to make her escape; and being intercepted in her flight, the city soon after surrendered. The victor sullied the glory of his conquest by ordering the execution of Longinus, author of the famous treatise on the "Sublime," and other advisers of the unfortunate queen; but in other respects the city was treated with great lenity. Unhappily, however, as soon as it was understood in Palmyra that the emperor, with his captive princess, had crossed the Hellespont, the citizens rose in rebellion, and having massacred the Roman governor and garrison, proclaimed their independence. The instant Aurelian heard of this revolt he retraced his steps, and hastened to the ill-fated city with an irresistible force and an insatiable thirst for vengeance. The sequel may be learned from his own words—"Mulieribus non peperimus, infantes occidimus, senes jugulavimus, rusticos interemimus; cui terras, cui urbem deinceps relinqueremus? Parendum est iis qui remanserunt" (Flavius Vopiscus in "Hist. August.," p. 218). Zenobia herself was taken to Rome to grace the triumph of Aurelian, who, however, behaved towards her with a generous clemency seldom exercised by the ancient conquerors, and presented her with an elegant villa at Tibur, where the Syrian queen insensibly sunk into a Roman matron, her daughters married into noble families, and her race was not yet extinct in the fifth century. ("Decline and Fall," ii. 44-48.)

The latest historical notice of Palmyra is its plunder in 1400 by the army of Tamerlane. It is now a ruined place, inhabited by a few Arabs. The remains of Palmyra, which cover a surface of about 3 square miles, mostly consist of a great number of columns, portions of a temple of the

sun, occupying a quadrangular space of 740 feet on each side. This was inclosed by a wall 70 feet high, which had a double row of columns, 100 of them still remaining. There are also fragments of some other temples, several gateways, traces of an aqueduct, and numerous sepulchres on the sides and summits of the adjacent heights. The numerous ruins and columns make a striking appearance as they are seen from the desert, but few of the remains possess great architectural merit, and on the whole they are inferior in grandeur and style to other Syrian remains. The ruins of the temple of Baal, the sun-god, are the most interesting, and much information as to the ancient caravan system has been gained from inscriptions found in its courts. Thus the chieftainship of a caravan was deemed a most honourable office by the ancients, and its safe-conduct a very creditable achievement. Previous to starting its principal members elected a leader and head, a man of experience in travelling, well acquainted with the direction, and qualified by firmness and conciliation to deal with the wild tribes by the way. By a prosperous journey he established a claim to gratitude, and after several a kind of honorary title was in some instances conferred, similar to that of emperor, with which the Roman legions greeted a successful general. Thus one inscription at Palmyra commemorates Aurelius Zehida, who discharged his office of conductor with great credit while leading a company of merchants from that city to Voloesia, a town on the Euphrates, in order to attend the markets held there. Another is in honour of a certain Schalmalath, who is expressly said to have been a Jew, and whose services had procured for him a statue, as well as an inscription, erected by the senate and people of the city. The modern name of the court of the temple is the Court of Camels, and the arrangements sanction the surmise, that as the commercial interests of the city were supposed to be under the special protection of the tutelary deity, the caravans wended their way to the temple on arriving and started from it. Hence it had appurtenances for their accommodation, answering the purpose of a caravanserai—the apartments being for the passengers, the court and tanks for the beasts of burden and the goods they conveyed.

PALMYRA PALM. See BORASSUS.

PA'LO DI VACA. See COW-TREE.

PALPICORNIA is a group of BEETLES belonging to the section Pentamera. This group is distinguished by the length and slenderness of their maxillary palpi. The antennae are short and club-shaped. Only two families are included in this group: Hydrophilidae, aquatic and vegetable-feeding beetles of large size [see HYDROPHILUS]; and Sphaeridiidae, beetles living on the dung of land animals.

PALSY. See PARALYSIS.

PAMIR' (meaning "roof of the world"), a plateau of Central Asia, rising between Eastern Turkestan and Bokhara, Russian Khokan, on the north, and Badakshan and Wakhan on the south. The Trans-Alai and Kizil Yart chains rise on its northern and north-eastern borders; the Hindu Kush and Mustagh ranges may be said to limit it on the south. Its general elevation is from 12,000 to 15,000 feet, but many of the summits on its borders rise to 25,000 feet. It is drained to the westward by the head streams of the Amu Daria or Oxus, which is formed by the confluence, at about 70° E. lon., of the Surkhah and Panja. The Pamir was first correctly described by Marco Polo. It affords fine summer pasturage for the flocks of the Kirghiz.

PAM'PAS, an Indian word signifying an extensive level of country rich in shrubs and various grasses, but nearly destitute of trees. In South America, especially in the province of Buenos Ayres, these plains extend for about 1800 miles to the main ridge of the Andes which separates that territory from Chili. They are extensively

covered with luxuriant herbage, which affords subsistence to innumerable herds of horses and cattle. These pampas vary in width from 300 to 900 miles, and differ materially in climate. One of these regions is covered with thistles and clover; another produces long grass; and the third, which reaches the base of the Cordilleras, is a grove of low trees and evergreen shrubs. The first of these regions, however, varies with the seasons in a most wonderful manner. In winter the leaves of the thistles are large and luxuriant, and the whole surface of the country has the rough appearance of a turnip-field. The clover in this season is extremely rich and strong, and the sight of the wild cattle grazing in full liberty on such pasture is very beautiful. In spring the clover has vanished, the leaves of the thistles have extended along the ground, the country still looks like a rough crop of turnips. In less than a month the change is most extraordinary; the whole region becomes a luxuriant wood of enormous thistles, which have suddenly shot up to a height of 10 or 11 feet, and are all in full bloom. The road or path is hemmed in on both sides; the view is completely obstructed; not an animal is to be seen, and the stems of the thistles are so close to each other, and so strong, that independently of the prickles with which they are armed, they form an impenetrable barrier. The thistles suddenly lose their sap and verdure, their heads droop, the leaves shrink and fade, the stems become black and dead, and they remain rattling with the breeze one against another, until the violence of the pampero or hurricane levels them with the ground, when they rapidly decompose and disappear; the clover rushes up, and the scene is again verdant.

The Pampas del Sacramento are extensive plains, very little explored, which run in a direction nearly north and south, to the eastward of the Andes, through the province of Peru. They contain upwards of 70,000 square miles, and are so level that they have been compared to an ocean. They are covered here and there with forests; and inhabited by different savage races of Indians, among whom the Spaniards had formerly some missionaries.

The Salt Pampa of Bolivia, or the Laguna de Salinas, forms at one time of the year a salt lake, at another a salt plain. It consists of a thick crust of a pure crystallized and dazzling white common salt, lying over an underground lake, nothing of which can be seen except where a sort of salt mine is being worked by the Indians. It forms an almost perfect level, and in the dry season may be crossed, though always at some risk of sticking in the swampy ground. In the rainy season it is quite impassable, the ground being then not only much softer, but also not unfrequently as much as 3 feet under water.

The whole area of the pampas has been estimated at 1,500,000 square miles. The wild animals are horses, oxen, and guanachos. The half-white inhabitants of the pampas are called Guachos.

PAMPAS GRASS (*Cyperium argenteum*), so called because it covers the South American pampas, is a hardy beautiful plant, whose leaves are from 6 to 8 feet long, and which shoots up into thick flowering tufted stems from 10 to 14 feet high. The panicles of the flowers are of a soft silvery white. It is prized in gardens for its ornamental appearance, but possesses no agricultural value.

PAMPELUNA or **PAMPLONA**, anciently *Iompeipolis*, a town of Spain, the capital of the province of Navarre, situated on a height in a plateau encircled by ramifications of the Pyrenees, 200 miles N.N.E. of Madrid. It is a place of great strength, regularly fortified, and defended by a citadel built by Philip II., and consists generally of straight and spacious streets, lined by indifferent houses. It possesses several fine promenades, one within and other three without the walls. The principal objects of note are the Gothic cathedral, containing the tombs of the kings of Navarre, a large bull-ring, aqueduct with

ninety-seven arches; town-house, governor's house, episcopal palace, mint, court-house, a college, diocesan seminary, theatre, &c. The manufactures and trade are unimportant. The annual fair, which lasts eighteen days, is numerously attended both by Spaniards and French. The population is about 25,000. On the north-east lies the Pass of Roncesvaux, in which the army of Charlemagne was checked by the mountaineers upon its advance into Spain in 778. Further east are the baths of Panticosa, a village about 5000 feet above the sea, in a basin-shaped valley surrounded by naked rocks and tremendous precipices, visited by Spaniards of the upper class for a short time in the height of summer.

PAM'PELET, a term of uncertain derivation, regarded by some etymologists as coming from the Spanish *papaleta*, an inscribed slip of paper, and by others from the Latin *pagina flata*, a threaded page, applied to any small unbound book, consisting of not more than five sheets of printed matter. The word occurs in the "Philobiblion" (1314) of Richard de Bury and in Chaucer; and it was used in the first instance merely to indicate the extent of the publication, and without reference to its contents. At a later period it was applied to short poetical effusions, but in the eighteenth century it assumed the meaning of a short controversial tract in prose.

Works of the latter description, under other names, however, had long before this exercised considerable influence over English history, and as early as the fourteenth century Wyclif and his followers employed short tracts and leaflets, written in the common language of the people, to disseminate their principles. The introduction of the printing-press gave an immense impetus to the production of short treatises of a controversial character, and since that period every important political event has called forth a series of pamphlets, reflecting with more or less accuracy the passing phases of public opinion. The rise of Puritanism in England, and its development in the Commonwealth, were attended throughout by an increasing flow of pamphlets, some of which, like the "Areopagitica" of Milton in favour of unlicensed printing, and the "Killing no Murder," aimed at Cromwell, attracted widespread attention, and exerted a wonderful influence at the time. The Catholic controversy during the reign of James II. also gave rise to an immense issue of tracts and pamphlets, and during the early part of the eighteenth century political writing of any degree of authority was almost entirely confined to pamphlets. With the beginning of the present century the rise of the quarterly reviews and the institution of monthly and weekly periodicals opened new channels of publicity to political writers, and the pamphlet declined in consequence; but at the present day, notwithstanding the immense development of periodical and newspaper literature, there are few public events of importance that are not attended by the issue of separate tracts and papers of this character.

Though generally short-lived and limited in scope, such productions have a special value for historians, and most of the great libraries acquire and preserve all the pamphlet literature they are able to obtain. The British Museum rejoices in the possession of an enormous number of English and foreign pamphlets, and there are some valuable collections in the libraries of the London and the Royal Institutions.

PAN, a deity of the Greek mythology, whose country was Arcadia. He was the tutelary god of the shepherds (Gr. *paio*, to feed, pasture), and was the son of the god Hermès by the nymph Kallistò. Pan is represented with horns, a goat's beard, tail, and feet, holding the syrinx, or pandean pipes, which he was said to have invented. The Satyrs are his attendants. He was said to have accompanied Bacchus to India, and upon one occasion, by uttering a loud scream, which was repeated by the echoes, he scared away the enemy. Another myth is that he

frightened away the Titans with his screams when they attacked the gods of Olympus. From these incidents the expression "panic fear," meaning a terror produced by no obvious or sufficient cause, appears to have been derived. The worship was introduced into Italy, where he was called Pales, Fannus (=Panus), and Inuus. The similarity of the Greek name with the Greek word "all" (*pan*) led to absurd effects of folk-etymology. Homer declares that this shepherd god of pastures (Gr. *paîō*) had his name Pan because he amused *all* the gods! Later poets looked upon him as in some way the god of *all* nature, representative of the Kosmos, a manifestly incorrect attribute for this half-barbarous wild figure, all noise and coarse jollity.

PANACEA (Gr. *panakeia*), a remedy which is supposed to cure every kind of malady. In the myth Panacea was a daughter of *Æsculapius*, the god of medicine, and, in conjunction with her sister Hygieia, possessed the power of healing all diseases.

PANAMA CANAL. From the time of the DARIEN EXPEDITION, in 1698, many schemes have been put forward and many attempts have been made to carry out, in one direction or another, one of the chief projects of that expedition, namely, "a great road from sea to sea, and a deep canal for ships." So long since as 1843 M. Garella made a report to the French government as to the facilities that this part of the isthmus offered for the construction of a ship canal. A commission appointed by the French government to report on the project declared in favour of the feasibility of the proposals, but as it involved a tunnel more than 3 miles in length, the commission observed that this feature of the scheme would not only be inconvenient to vessels, but would involve great cost, since the tunnel must be high enough to allow of vessels passing through with their lower masts standing. The scheme, for these and other reasons, thus came to nothing, but it is interesting as the first well-considered plan for a ship canal across the isthmus.

Between the Panama line and the province of Chocó three other routes for a ship canal have been at different times suggested—the first, from the Chepo or Bayanas River to San Blas or Mandinga (sometimes called Mamzanilla) Bay; the second, from the Gulf of San Miguel to Caledonia Bay; and the third, from the same gulf to the southern part of the Gulf of Urabia or Darien.

One of the first, if not the first, really comprehensive surveys made of the Chepo and San Blas route was carried out in 1864 by Mr. F. M. Kelley, of New York, who reported that the whole length of the route from ocean to ocean was only 30 miles; that on the north, San Blas furnished a safe, deep, and spacious harbour; and that on the south, the channel leading into the Bay of Panama had not less than 18 feet of water at mean low tide, while the ordinary rise of the tide was 16 feet. Nothing came of Kelley's survey, which was not a governmental but a private enterprise—probably for one reason, because he, like Garella, suggested a considerable amount of tunnelling. The San Miguel and Caledonia Bay route has been explored at different times by the governments of the United States, France, and Great Britain, but without leading to any more definite results than an inconsiderable accession to our geographical knowledge of the country.

The social and commercial advantages of the Panama Canal have been clearly understood and expressed by various writers on the subject, and the government of the United States has frequently shown its high appreciation of the advantages that were to be anticipated from piercing the isthmus, but its appreciation has never taken a practical shape.

In 1878, at the time of the International Exhibition being held in Paris, a congress was convened by the French Geographical Society, and was attended by about 140 scientific and practical men. M. de Lesseps, who had so

successfully grappled with all the difficulties of the Suez Canal, threw himself enthusiastically into the Panama Canal scheme, and advocated a broad and deep tide-level ship canal, as opposed to all the other schemes, each of which involved some twenty locks or 12 miles of tunnel, and in several cases a combination of both. De Lesseps' plan was the one approved of by the congress, which also agreed with his proposal that the canal ought to extend from Limon Bay to the Bay of Panama.

It will be seen from the map prefixed to this volume that the port of entry of the canal on the Atlantic coast is at Colon. From this point the canal, skirting the morass of Mindi, passes into the valley of the Chagres at Gatun, whence the line follows the valley to San Pablo, between the railway and the river on the left side, cutting the river at several points, and crossing the railway at San Pablo. Thence the line of the canal passes to Matabichin, cutting many bends of the river *en route*, and following generally the right bank, which is quitted at Matabichin, where the canal enters the valley of the Obispo. The river at Matabichin, at low water, is 44 feet above the level of the sea. The average fall of the bed of the river is only 1 in 3300. In the valley of the Obispo the surface is very irregular until Empedador is reached, at 200 feet above sea-level and $2\frac{1}{2}$ miles from Matabichin. The line through this cutting has been laid out with curves of about a mile radius. The canal has a total length of 46 miles. The floor of the canal, elsewhere than in the Culebra cutting, is 72 feet wide, being the same as that of the Suez Canal. The depth of water is from 26 to 29 feet. In the cutting through the Cordilleras the sides of the rock are at a slope of 1 in $1\frac{1}{2}$, the width at the bottom is $78\frac{3}{4}$ feet, and the depth of water is $29\frac{1}{2}$ feet, for additional margin of security in the cutting. The total quantity of cutting is estimated at 100,000,000 cubic yards, of which nearly one half is in rock. The rise and fall of the tide at the north varies from $7\frac{1}{2}$ to 19 inches, and at the south from 8 to $21\frac{1}{2}$ feet. The technical commission appointed to examine into the subject estimated the total cost of the works at about £34,000,000 sterling. From an engineering point of view the most serious problem to be solved in the construction of the Panama Canal is the control of the floods of the river Chagres, so as to prevent the canal from being damaged during the rainy season. For this purpose a dam 131 feet high is being made at Gamboa, near Cruces, and this structure, damming the valley through which the river flows, will be the means of retaining a vast lake of over 1,000,000,000 cubic yards capacity, which M. de Lesseps has stated to be much above the amount furnished by the greatest floods. The problem otherwise, as stated by M. de Lesseps himself, is "reduced to these terms—the utilization on the Atlantic side of the valley of the Chagres, and on the Pacific side of the valley of the Rio Grande, the beds of both rivers consisting of alluvium, easily removed by excavation." A ridge of high ground $8\frac{1}{2}$ miles across and 147 feet in altitude separates the two valleys, and this the canal has to traverse. The principal cutting will thus be carried over about 9 miles of distance to a depth of nearly 150 feet. Considerable progress has been made, but some observers believe that the cost of the canal has been enormously underestimated, and that even £100,000,000 will not cover it. One of the difficulties and dangers encountered is the terrible downpour of the tropical rainfalls, which wash away the banks. The total rainfall is 120 inches a year in this district, and falls of 6 or 7 inches in an hour or two are not rare! The climate, too, is very unhealthy, much of the district being a swamp, and nearly all the work has to be done by negroes.

PANAMA, THE ISTHMUS OF, constitutes the most eastern and the narrowest portion of the long isthmus by which North and South America are united. Its length is about 200 miles, and its average breadth 40 miles, but

in lon. 79° W. it is narrowed to less than 30 miles. The surface is undulating: the hill chains which extend through the isthmus, uniting the mountain systems of South and Central America, are not more than 270 feet above the level of the Pacific near Panama. The soil is very fertile, and a great quantity of rain falls; indeed, in the months of July, August, and September it usually rains incessantly.

The country is very rich in vegetable productions. Sugar-cane, forest trees, dye-woods, fruits, esculent vegetables, rice, maize, &c., grow very abundantly. Cattle, horses, and mules are reared in those districts where there are natural prairies or savannahs. The woods are inhabited by numerous wild animals. The sea abounds with fish, especially sharks, alligators, and turtle. Gold, copper, iron, tin, mercury, and limestone are the chief mineral productions. There is a good trade in coffee, cocoa, caoutchouc, vanilla, dyes, drugs, hides, &c.

The isthmus contains several good harbours, of which those of Puerto Bello and Chagres are the best known on the Atlantic side, and Panama on the Pacific. A portion of the isthmus is still in possession of the aborigines. The population of those parts in which European settlements have been made consists chiefly of mulattoes and negroes, the number of whites being comparatively small, except in Panama and in the larger towns. The total number of inhabitants in the isthmus is about 220,000. In 1855 Panama or Ystmo was erected into a new republican state by an Act of the Congress of New Granada. See **COLOMBIA**.

A railway across the isthmus—from Colon (or Aspinwall), on the Atlantic, to the town of Panama, on the Pacific—completed in 1855, is a single line of 47 miles in length. Starting from ASPINWALL, the Atlantic terminus, the line passes over marshy ground to Gatun, on the Chagres River; then through a dense tropical forest and the highest ground of the isthmus. The elevation here is about 250 feet above the sea, and there is a rapid descent of 11 miles to the town of Panama.

PANAMA, a city of Colombia, on the south coast of the Pacific side of the isthmus, and the terminus of the railway from Aspinwall, on the Atlantic. It stands upon a tongue of land, and the streets extend across from sea to sea. Notwithstanding its beautiful situation it is a poverty-stricken, half-burnt-down, old-fashioned Spanish town. It has not even an almshouse; hardly anywhere a tree in a private or public garden. A destructive fire in 1879 destroyed many of the stately buildings round the main square. There are a dingy cathedral and other weather-beaten churches, their façades and towers in their present state more remarkable for their ruinous condition than for any architectural beauty. The town contains about 18,000 inhabitants. Its harbour is protected by numerous islets, and affords secure anchorage. The country round is fertile and provisions are plentiful. The trade of Panama may be divided into two classes—the trade proper, import and export, and the transit trade. The import trade consists of dry goods, fancy articles, glassware, preserves, liqueurs, hardware, salt provisions, and earthenware. The exports consist chiefly of india-rubber, hides, and nuts. Panama is a free port, and is a station for the mails between Great Britain, Peru, and Chili.

PANATHENAI, the greatest of the Athenian festivals, was celebrated in honour of Athēna as the guardian deity of the city of Athens. It is said to have been instituted by Erichthōnion, son of Hephaistos, and to have obtained the name of Panathēnaia in the time of Thēseus, in consequence of his uniting into one the different independent states into which Attica had been previously divided. There were two Athenian festivals which had this name, one of which was called the Great, which was celebrated once

in every five years, and attracted spectators from all parts of Greece; and the other, the Less, which was celebrated every year in the Peiræus (*Piræus*). The great Panathēnaia was celebrated on the 28th day of the first month. Its most important ceremonial was the procession, in which was carried the crocus-coloured Peplos, or sacred shawl of Athēna. This procession formed the subject of the bas-reliefs which embellished the frieze of the Parthenon, a considerable portion of which is in the British Museum. The procession was followed by sacrifices of bulls, and then games of all kinds succeeded, races on foot, on horseback, and in chariots, torch-races by night (*lampadephoriai*), wrestling-matches, competitions in poetry and music, discussions by philosophers, &c. The prizes were vases of olive-oil from the sacred tree of Athēna on the Akropolis.

PAN'AX is a genus of plants belonging to the order **ARALIACEÆ**. *Panacæ quinquefolium* is a native of North America, and the roots are often exported for medicinal use as ginseng. The flowers are small, greenish, and arranged in an umbel. There are five petals, five stamens, and eight styles. The name Panax is adapted from the Greek *panakes*, a panacea or remedy for all diseases.

PAN'CHA TAN TRA (that is, "the five books") is the name of the famous collection of fables in Sanskrit whence the less ancient **ITIPRADIŚA** was compiled. The fables are interwoven on a regular plan, one growing out of another (much as do the tales in the "Arabian Nights"), and each one being accompanied by its moral and *résumé*, so that the whole forms a course of moral educational training with pithy examples easily to be remembered. The authority on the *Pancha Tantra* is Beufey, whose work (German) is still without an English translator ("The Five Books of Indian Fable, *Pancha Tantra*," two vols., Leipzig, 1859). In the enlarged and altered form of the *Hitopadesa* this fine work is now readily obtainable in English for a shilling (Wilkins' translation of 1787, in Morley's Universal Library, 1885). The work was first brought to the notice of Englishmen as the fables of PIL'AY.

PAN'CRAS, ST. (*Pancratius*), was a noble Roman youth martyred under the Diocletian persecutions at the age of fourteen, in the year 304. He is therefore especially the patron saint of youths and children in the Roman calendar.

PANCRATION. See **PANKRATION**.

PAN'CREAS (sweetbread), a secreting gland situated behind the stomach, and extending from the spleen transversely across the vertebral column to the duodenum. In man it is of an elongated and slightly-flattened form, broadest at its right extremity, and gradually diminishing in breadth towards the left. It is of a firm consistence, lobulated, and very similar in structure to the salivary glands, secreting moreover a fluid of very similar character, from which circumstance it is often called the salivary gland of the abdomen. Its function is to assist in the assimilation of the food.

The pancreas in man discharges its secretion into the duodenum (the small intestine) through a small opening, sometimes through a duct common to it and the liver (bile). The pancreatic secretion is colourless, transparent, and slightly viscid, and has an alkaline reaction, with a specific gravity of 1010 (compared with water, 1000), and containing from 8 to 10 per cent. of solids. The latter are divided into inorganic substances, chiefly carbonate of soda, proteids (including serum-albumen, casein, leucin, and tyrosin), and fats, with a curious and little understood characteristic ferment. The action of this secretion is to convert the proteids of the food into peptones and the starches into glucose (exactly as does the saliva), and especially to split up the oils and fats by breaking their globules with a fermentative action. It seems to have no action on nitrogenous bodies, such as gelatin, horny tissues, &c., which are not proteids. Numerous experiments seen

to show that any stoppage of the pancreatic action causes the fats of the food to be almost wholly undigested; and Claude Bernard was even disposed to limit the office of the pancreas to the emulsification of fat. It is now usual to consider this rather as its chief, than as its only, function. The sweetbread (pancreas) of calves and of lambs is a well-known delicacy for the table. The name is the Greek *pankreas*, all flesh, i.e. without gristle, fat, or bone—all meat.

PANCREATIN, a fermentive principle soluble in water, which is precipitated by alcohol from the pancreatic juice. It is much employed in medicine, and is usually prepared from the pancreas of the pig. It contains ferments which convert the starch of the food into sugar, and also emulsify and saponify the fatty matters, and thus it materially aids a weak digestion. Fats are often administered in pancreatic emulsion for easy assimilation.

PANDA (*Ailuropus fulgens*) is a small carnivorous mammal belonging to the family Ailuridae, and nearly allied to the bears (Ursidae). The panda is an inhabitant of the Himalayas and Eastern Tibet. It is a short-muzzled, round-headed animal, covered with full soft fur, and having a bushy tail nearly as long as the body. Like the bears its mode of progression is plantigrade, that is to say, it applies the whole sole of the foot to the ground when walking. The dentition is expressed in the formula:—

$$3-3 \quad \frac{1-1}{1-1}; \text{ } pm. \quad \frac{4-1}{1-1} \quad \frac{1-1}{1-1}$$

In size the panda equals a badger, and is of a robust figure; its limbs are stout; its feet five-toed, but the soles instead of being naked are covered with thick close wool, of a pure white or grayish-white, forming a strong contrast to the deep black of the legs and under surface. The claws are large, sharp, and semi-retractile. The ears are short, pointed, and lined and tufted with white fur. The colour of the upper surface is a beautiful chestnut, the head being much paler; the muzzle is white, with a red dash beneath the eyes; the tail is banded red and yellow, but not very strongly; the limbs and under parts abruptly black. The fur consists of a soft, deep, woolly undercoat, with long hairs overlying it. It haunts the neighbourhood of rivers and mountain torrents, lives much in trees, and feeds on birds and the smaller quadrupeds. It is frequently discovered by its loud cry or call, resembling the woad Waa.

PANDANÉE is an order of arborecent or bushy plants, classed with MONOCOTYLEDONS, among which they are, more especially in the genus *PANDANUS*, remarkable for their stems forking repeatedly. In this order the flowers are unisexual or polygamous, and cover the whole spadix. The perianth is altogether wanting, or represented by a few scales. In the male flowers the stamens are numerous, stalked and two to four-celled; in the female flowers, the ovaries are generally in groups, one-celled, with sessile stigmas equal in number to the carpels; the ovules are single or numerous on parietal placentas. The fruits either have a fibrous husk, one seed, and are arranged in groups; or they are berries with many cells, each of which contains several seeds. The albumen is fleshy, copious, with a minute embryo. The leaves are spirally arranged and the stems throw out adventitious roots above the surface of the ground, which support them like buttresses.

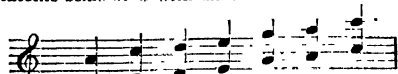
PANDANUS, a genus of plants which belong to the order *PANDANÉE*, or screw-pine tribe. The leaves resemble those of the pine-apple, and are inserted spirally along the stem. The species are found in the islands of the tropical ocean, in those of Mauritius and Bourbon, as well as in the southern parts of India. One species, *Pandanus odoratissimus*, being highly fragrant, is much esteemed in all Asiatic countries. Oil impregnated with the odour of its flowers and distilled water are highly esteemed both for their odour and their medicinal use as stimulants.

Pandanus utilis is a native of Mauritius, where its leaves, together with those of other species, are used to make the bags in which sugar is exported. When the bags are emptied of their sugar, they are cut up, and made into fish-bags. In this genus the male and female flowers are on different plants. The male flowers have no perianth, numerous stamens, and are arranged on a compound spadix. The female flowers contain a single ovule, and are closely packed in a globular head.

PAN'DEAN PIPES or **PAN'S PIPES**, the *syrtis* of the ancient Greeks (*σὺρτις*), and probably the instrument meant by the *ugab* of the Old Testament, as in Gen. iv. 1, where Jubal is described as the father "of all such as handle the *kinnor* and *ugab*," translated by "harp and organ" in the Authorized Version (1611) and by "harp and pipe" in the Revised Version (1881).

This most ancient instrument, possibly the earliest form of pipe, is still most familiar to us as the time-honoured usual accompaniment (with a drum to help it out) to the peripatetic drama of "Punch and Judy." Its origin was, of course, a hollow reed pulled from the river bank, and cut at a knot so that it was stopped at one end and open at the other: into this our far-away ancestor could blow as boys now blow into the pipe of a key, and the flutter of the breath against the sharp edge at the top was controlled into a regular vibration by the length of the pipe. [See ORGAN-PIPES.] Each pipe of the instrument is a stopped pipe, giving vibrations or sound-waves of four times its length, the shorter pipes giving shorter and hence more numerous waves, and yielding in consequence shriller notes. Several such pipes were arranged, so says the legend, by the god Pan, in a row which proceeded from short to long. Whoever did make such a series, whether Pan or another, would find that the pipes would be tunable by cutting, and so could be readily combined to form a scale of successive notes, or an *arpeggio* (a chord of notes spread out into separate sounds); also by arranging the pipes with their mouths in a horizontal line (and their stopped ends consequently in a diagonal), he would make the instrument easy to play, and either the whole series could be passed through, or any single pipe sounded, by shifting the instrument to and fro in front of the mouth by the hand as desired. The orchestra of Punch and Judy generally prefers, for many reasons, to keep his left hand free, his right being occupied with the drum, and therefore he plays on the pipes by moving his head to and fro, the instrument being firmly stuck into his waistcoat. As a matter of fact, not the prime tone but the first harmonic (i.e. the Twelfth, as it is a stopped pipe), is sounded by these pipes. The tone is slightly reedy and piercing, but flute-like and not unpleasant.

We are used, from these associations, to consider the pandean pipes as a coarse vulgar instrument; but it has had a not undistinguished history before sinking to its present level. In China it is still seriously played, having twelve pipes of bamboo in the *kwan-tse* form, and sixteen in the *pai-siao*; and in ancient Peru it was much cultivated by the Incas, the pipes being made of cane and also of a kind of soapstone. One of these *huayra-pukuris* is in the British Museum and has fourteen reeds, in two rows, bound together by thread; the lengths of the pipes in both rows vary by the same law, but the one set are open at the lower end and the other closed, the open pipes consequently sound an octave higher than the others. The pentatonic scale is used, that is, the Fourth and Seventh from the keynote are omitted. The actual sounds are as follows, a pentatonic scale of C with an added A below:—



Other Peruvian examples show holes in the pipes, so that more than one sound could be obtained from each pipe. The use of this instrument for serious music, even for the serenades of lovers to their mistresses, &c., is amply shown in the pages of Garcilasso de la Vega and other historians. We also find it repeatedly in the illuminated MSS. of the ninth to the thirteenth centuries in Europe, and it has survived as a national instrument to our own day in Roumania, where large specimens of twenty-five pipes each, the largest over a foot long, are found. One of them is in the South Kensington Museum. About 1800 the instrument rose to sudden popularity in England. Various sizes of it were made, and the performers were able thus to play in harmony. Altogether a range of four octaves was obtained. One teacher of the art (Davies) published a treatise with a method of instruction in 1807, by which we learn that the finest instruments were made of glass, not of reed. Pandean bands went out of fashion about 1825, as suddenly as they had arisen a quarter of a century before.

PANDECTS. See JUSTINIAN'S LEGISLATION.

PAN'DIT. See PUNDIT.

PANDORA (Gr. *pan*, all, *doron*, a gift), the first woman, created out of clay by Hephæstos, at the request of Zeus, to punish Prometheus for stealing fire from heaven, and thus making earth habitable. Zeus determined to convert this comfort into perpetual unhappiness, and thought of the charms of female beauty as the medium for attaining his ends. Into the newly-created lovely figure he therefore breathed life; mental and bodily charms were showered upon her by each of the gods, and she was sent to earth in charge of Hermes, who gave her to Epimetheus, the brother of Prometheus, who, though he had been warned to accept no presents from the Olympian deities, unwisely received her. In the house of Epimetheus was a jealously locked casket, in which all the ills of the universe had been imprisoned. Pandora, who possessed more than her share of every womanly charm, possessed also the usual feminine failings, and especially that of curiosity. She opened this casket, and the evils so carefully guarded immediately escaped. She, in her confusion, hurriedly closed the casket, but the earth was already overspread with numberless forms of misery and evil. Beneath them all had lain hope, the only blessing in the casket; Pandora was just quick enough to prevent the escape of this, and so to treasure up some feeble antidote for man, wherewith to counteract the ill she had wrought him. A later form of the legend would make Pandora to bring from heaven her own casket, and the contents of this casket to be blessings, not evils. All the blessings fled away and were lost, or were only to be caught on the wing now and again; hope was the only one permanently held fast. This perhaps is more useful for literary purposes, but the other is the original myth.

PAN'DROSOS (i.e. the all-bedewing), a daughter of Cærops (Gr. *Καρόπος*), the first king of Attica, is only noticeable as, for some reason now obscure, having attained to the honour of public worship in Athens. Her sanctuary, adjoining that of Athena Polias, has a beautiful portico supported by caryatids which is world-famous. It is figured both in plan and elevation in the fourth Plate of those illustrating GREEK ARCHITECTURE. In 1886 were dug up three archaic statues in some excavations on the Akropolis at Athens, and these were identified as temple images of Pandrosos and her two sisters.

PAN'DULF, CARDINAL, the legate who received the shameful submission of King John and his homage as the Pope's vassal in 1213 at Dover. He afterwards took part in obtaining Magna Carta (1215). He still remained in the kingdom, and was appointed one of the guardians of the youthful Henry III. Eventually he became Bishop of Norwich in 1218, and died at that town in 1226.

PANDU'RA, PANDORE, or BANDOER, a lute-like instrument in great vogue both in England and on the Continent from Elizabethan times till about 1700. There are several specimens of it in the South Kensington Museum, London. It differed from the lute in being played with a quill plectrum, like the zither or cither. A large sort was called *Orphanion*. The Spanish variety (*Ban-duria*) remained longer in vogue, and was often strung wholly or partly with wire, a tortoise-shell plectrum being preferred: examples of the present century are in the South Kensington collection.

The *Pandurina* was not a small pandura, as its name might imply, but rather a sort of mandoline, differing in having a more oval and flatter body, and in having the tuning pegs at the side of the curiously scrolled either-like head, whereas the mandoline had them at the back, the pins coming through the head; the latter in the mandoline being flat and inclined backwards at a sharp angle from the neck. The pandurina is an exceedingly handsome instrument in form.

PANEGYRIC (Gr. *paneguris*, a general assembly), in oratory, a term for an eulogistic harangue in praise of some person or persons addressed to a public audience, such as a funeral oration, or, to adopt the French word, *éloge*. It is now used in a wider sense for any laudatory discourse.

PANEGYRY (Gr. *panéguris*), a meeting (*agora*) of the whole people, as its name implies. The great Pan-Hellenic festivals (Olympic, Pythian, Isthmian, and Nemean games) for the European Greeks, and the Panionic festivals on Mount Mikale for the Greeks along the coasts of Asia Minor or Ionia, were examples of panegyrics. The religious character was always held the main thing, but the games were of course the chief object of attraction, and there was moreover a large amount of commercial and other intercourse transacted, making such meetings resemble in some degree the great European-Asiatic fairs of the present day.

A special meaning of panegyry is as a translation of one of the Egyptian hieroglyphics very frequent in the complimentary titles of kings. "Lord of panegyrics" or "Lord of periods" is a title derived from a sort of jubilee festival celebrated upon a monarch's attaining the thirtieth year of his reign, and thus outlasting a whole generation of his subjects. In the article OBELISK the expression will be found used in the inscriptions on Cleopatra's Needle, now in London.

The word "panegyric," a laudatory harangue, comes from this source. It is evidently with such a form of festival oratory that a judicious president would seek to win the goodwill of the assembled multitude at a panegyry.

PAN'EL, now most commonly a board inclosed in a frame, was originally a piece of cloth (diminutive of Low-Latin *pannus*, cloth), and hence such a piece when stretched as a wall-hanging or for embroidery. To *enpanel* (a jury) is to inscribe the names on a panel, as one writes on a slate.

PAN'GOLIN (*Manis*) is a genus of mammals belonging to the insectivorous section of the order EDENTATA, and representing in Africa and India the ant-eaters and armadillos of South America.

The Pangolins, or Scaly Ant-eaters, may be known at once by the armour of dense horny scales or triangular plates overlapping each other, by which every part of the body, except the middle line of the under surface, is completely invested. The body is depressed, rounded above, long, and low. The head is small and conical; the eyes are minute; the ears are very small; the mouth is small, and the tongue long and extensible; there are no teeth. The tail is long, broad, and covered above and below with hard imbricated scales. The limbs are very short and thick, and mailed like the rest of the body. No distinct toes are apparent beyond the claws, which on the fore feet are five

in number, the three central ones being of enormous size, curved, laterally compressed, and bluntly pointed. The first and the last claw are very small. The large claws fold down on a thick coarse pad, as in the ant-eater; and the mode of progression in both cases is the same. The hind feet have five short, thick, blunt claws, edging a pad-like sole, which is covered with coarse granular skin, and so protuberant that the claws do not fairly touch the ground. The ungual phalanges, or last joints of the toes, both of the fore and hind feet, which are sheathed by the claws, are remarkable for being bifurcated at their extremity, a



Pangolin (*Manis Temminckii*).

peculiarity found in no other animals of the edentate order. The osseous framework generally is moulded upon the same plan as that of the ant-eaters. Slow in their motions, and unfurnished with efficient weapons of offence, the pangolins defy the assaults of almost every foe. When attacked they roll themselves up into a ball, wrap the tail over the head, raise up all the pointed and sharp-edged scales in serried array, and thus invulnerable, conquer by passive resistance. The food of these animals consists of termites and ants, which they take by means of their long glutinous tongues, in the same manner as the ant-eaters. They dwell in holes and burrows. Some are able to climb trees. The species are rather numerous. The African species range from Senegal to West Africa and the Cape. The Long-tailed *Manis* (*Manis tetradactyla*) is from 2 to 3 feet in length, and the tail is twice as long as the body, containing no less than forty-six vertebrae. The body is dark brown, with the hairs of the face and under parts black. Three other African species are known, *Manis Temminckii*, *Manis tricuspis*, and *Manis gigantea*. The Asiatic pangolins are distinguished by the presence of scattered hairs between the scales of the upper surface. The Short-tailed Pangolin (*Manis pentadactyla*) is found in India and Ceylon; *Manis javanica* ranges from Burma to Borneo; *Manis aurita* is found in the Himalayas and China.

PANICLE is a kind of inflorescence, or arrangement of flowers, in which the axis is divided into a number of lateral branches, each of which is again subdivided into other branchlets. Examples of it may be found in the lilac and the horse-chestnut.

PAN'ICUM, a genus of GRASSES the name of which was applied to one of the species (millet) by the Romans, and which, Pliny states, is so called from its flowers being in a panicle. The genus contains a very large number of species, which abound in the hot parts of the world, though a few extend to higher latitudes and ascend the cool mountains of hot countries. Each spikelet has two flowers, one perfect, the other imperfect. They are chiefly valuable as pasture grasses, and for their seeds, which form a large portion of the food of the poorer classes of many nations. *Panicum miliaceum* or Millet, is the best-known species. See MILLET.

PANINI, the most celebrated of the Sanskrit grammarians, is said to have flourished in the sixth century B.C. and to have been a native of the village of S'alatura, situated north-west of Attock, on the Indus. His Vyākaraṇa, or grammar, a work designed upon a plan utterly unlike the grammatical works of Europe, is divided into eight

books, and comprises 3996 *sūtras* or aphoristic rules. These are drawn up with such oracular brevity and obscurity, that they need a commentary to render them intelligible even to learned Hindu scholars, and to master them requires years of patient study. Max Müller says it must have required ages of observation and collection before the plan of such a work could be conceived and carried out by one individual.

The *Sūtras* of Panini, with a modern commentary and extracts from the commentaries of the ancient grammarians Kātyāyana and Patañjali, was published at Calcutta in 1809, and reprinted with some omissions at Bonn in 1839-40. (See also Colebrooke's "Grammar of the Sanskrit Language," Calcutta, 1805; and Goldstücker's "Panini, his place in Sanskrit Literature," London, 1861.)

PANIZZI, SIR ANTONIO, K.C.B., some time principal librarian of the British Museum, was born at Brescello, in the duchy of Modena, 16th September, 1797. After taking his degree at the University of Pavia he commenced life as an advocate, and soon obtained a fair measure of success. An earnest patriot he was implicated in the Piedmontese revolution in 1821, but although condemned to death he managed to escape, and after wandering for a time in Switzerland and Germany, he reached England in an almost destitute condition in May, 1823. He was introduced by his countryman Foscolo to the historian Roscoe, who assisted him to establish himself as a teacher of Italian in Liverpool. Roscoe also introduced him to Lord Brougham, who made him, in 1828, professor of Italian in University College, London. In 1831, Brougham having become lord chancellor, he procured for his friend Panizzi an appointment as assistant librarian in the British Museum, and in 1837 he succeeded to the keepership of printed books. In this capacity he superintended the transference of the books from Montagu House to the new building, reorganized the reading-room service, and made preparations for the printing of a catalogue. By his influence the annual grant for the purchase of books was largely increased, the number of books in the national collection was increased to treble its former extent, and the magnificent reading-room of the museum was erected. [See BRITISH MUSEUM.] In 1856 he succeeded Sir Henry Ellis as principal librarian, and retained this office until July, 1866, when he retired on a liberal pension. In 1869 he was created a K.C.B. He died 8th April, 1879. His literary labours include the editing of Boiardo's "Orlando Innamorato" and the "Orlando Furioso" of Ariosto (nine vols., 1830-34), prefaced by a valuable essay on the influence of Celtic legends on mediæval romance, and dedicated to his benefactor Roscoe; an edition of the "Sonetti e Canzoni" of Boiardo, in 1835; and a number of pamphlets and critical papers.

Although he became a British subject by adoption Panizzi never lost his fervent love for his native country, and his personal friendship with many eminent Liberal statesmen enabled him to render important and valuable, though secret, services to the cause of Italian unity. After this unity had been accomplished the Italian government, out of gratitude, offered him a senatorship and the direction of public instruction in Italy, but he preferred to retain his English citizenship and position in English society. (See L. Fagan's "Life of Sir Anthony Panizzi," two volumes, London, 1880.)

PANJAB. See PUNJAB.

PANKRAT'ION (Gr. *παγκράτιον*, Lat. *Pancration*), an athletic contest among the ancients in which every variety of feats of strength of the nature of boxing and wrestling was included (Gr. *pan*, all; *kratos*, strength), the challenged party having the right to begin with boxing or with wrestling, as he chose. The combatants were quite nude and were thickly oiled, but lightly sprinkled with sand. A fight in the pankration was often fatal, and if

not so bad as that was never broken off until one of the combatants was quite unable to move.

PANNO'NIA, the ancient Roman province on the Danube, lay to the west of Dacia and to the south of Germany Proper, the great river forming its boundary on both sides. The Julian Alps separated it from Italy. Its modern equivalents are Eastern Austria, Hungary between the Danube and Save, Styria, Carinthia, Slavonia, and part of Bosnia and Croatia. Augustus first conquered the Pannonians 35 B.C., but they afterwards revolted and were with difficulty reconquered by Tiberius, acting as the emperor's general, A.D. 7 to 9. Pannonia was then thoroughly garrisoned and reduced to a Roman province. It furnished vast forces to the empire, and was one of the most valuable frontier provinces. In the fifth century it was conquered and occupied by the Huns, and after the death of King Attila, by the Ostrogoths, and then the Lombards (Longobards).

PANORAMA (Gr. *pan*, all, and *horaa*, a view), a picture showing a view completely around the spectator. This ingenious pictorial contrivance was first devised by an English artist, called Robert Barker, about the year 1791; but it is not so much a new mode of painting—the process itself being similar to scene-painting or in distemper—as a novel application of it. Contrary to the DIORAMA, the panorama forms the surface of a hollow cylinder or rotunda, in the centre of which is a detached circular platform for the spectators, covered overhead to conceal the skylight, and thereby increase the illusion and give greater effect to the painting itself. The view is not painted on the walls, but upon canvas, like the scenes of a theatre, and afterwards fixed up. The subjects formerly preferred for exhibition were views of cities, or interesting sites, whose entire locality and buildings could thus be vividly placed before the eye, in a manner no less instructive than interesting; but more recently battle scenes have been chosen as the most fitting subjects for illustration, and of these some really splendid pictures have been painted and exhibited.

PANSLAVISM is a term applied to a movement which dates from the early years of the present century, for the amalgamation into one great nation of all the races of Slavonic descent. The early Slavonians were the progenitors of the Russians, Poles, Bohemians, and some other peoples in the east and north of Europe, but in the course of time these races became intermingled with nearly all the nations of Eastern Europe, and acquired different languages and religions. When, however, the downfall of Napoleon aroused in Europe a passionate enthusiasm for national unity throughout Europe, the conception of a vast united Slavonic kingdom was formed among the Slavs of Bohemia, and their aspirations found utterance in the writings of the poet Kollar, the historian Palacky, and other scholars and authors. As at this time the Austrian government was doing its utmost to Germanize Poles and Czechs, and Magyarize Scythians, Slovaks, and Croats, these writings attracted great attention among the Slavonic races, and helped greatly to strengthen the sentiment of nationality among them. In 1848 a Panslavic Congress was summoned at Prague, which was attended by Slavonians from Bohemia, Moravia, and Silesia, and by Slavonic Poles, Croats, Servians, and Dalmatians, all of whom appeared in their national costumes, but who in regard to language found they could only make themselves mutually intelligible by using the hated German. The meetings of the congress proved to be of a stormy character, and it was at last summarily broken up by the government, the leading agitators being imprisoned. During the next few years the Panslavic movement was strongly supported in Russia, but it received a check when the weakness of that empire was shown in the Crimean War of 1854-55. After the conclusion of that war, however, the agitation was con-

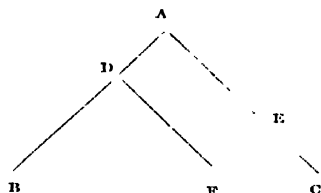
tinued by Russia, the idea of freeing the subject Slavonic races of Turkey being that which received most attention. In most of the Russian towns Panslavist committees were formed with the object of supplying arms and ammunition to the Slavonians of Herzegovina, Servia, Bulgaria, &c., in order to enable them to rise in insurrection. The rising in Herzegovina in 1875, and the war between Servia and Turkey in 1876, were chiefly brought about by the secret Panslavist committees of Russia, and they must also be regarded as the chief indirect cause of the war between Russia and Turkey in 1877. The final results of this conflict were hardly satisfactory to the Panslavists, either in the extension of Russian influence abroad, or in the equally desired overthrow of absolutism at home, and hence they have continued their intrigues in the Balkan Peninsula. The movement in Roumelia in favour of union with Bulgaria in the autumn of 1885, was generally attributed to the influence of the Russian committees, and in this case it seems certain that their action was taken quite independently of the Russian government.

The ideas connected with Panslavism are at the present time somewhat potent factors in the intricate Eastern question, and it seems reasonable to suppose that the movement has an important future before it. In Russia it serves to direct attention to the glaring imperfections of the home government, and thus tends to increase the revolutionary feeling so rapidly growing in that country; while its influence upon the Slavonic nationalities outside keeps them in a state of continual unrest and excitement. Should the schemes of the Panslavists ever be carried out, they would tend not only towards the dismemberment of the Ottoman, but also of the Austrian Empire. The Slav states that owe allegiance to the court of Vienna would inevitably be attracted to the Slavonic Empire, just as the minor states of Italy were attracted round Piedmont, and those of Germany round Prussia. Up to the present the Austrian rule can scarcely be called assimilating, the various races that own allegiance to the yellow and black flag still retaining their individuality, and in a great degree their mutual animosities. The Slav races, for instance, who constitute 49 per cent. of the Austrian population, and 16 per cent. of the Hungarian, regard with peculiarly jealous and bitter feelings their fellow-countrymen the Magyars, who form the most important of the various Hungarian races, while both Slavs and Magyars dislike the Germans. If by any means the secession of the Slav provinces of Austria were to be brought about, it would to all human appearance be followed by an entire disruption of the empire. Hungary would probably become an independent kingdom, the German provinces would go to Prussia, and the Italian Tyrol with some others to Italy. In such a case Russia would find the road to Constantinople open and easy, and any danger of the reconstitution of the Polish kingdom would be removed for ever. Without hazarding any speculations as to the probability of so momentous a consummation as this, it is evident that in the ultimate settlement of the Eastern question, Austro-Hungary will be almost as much affected as Russia or Turkey, and that Panslavism will in all probability play an important part in the final solution. (See E. L. Mijatovic's "History of Modern Servia," London, 1872; and D. M. Walker's "Russia," two volumes, London, 1877.)

PANS'Y, a corruption of the French word *pensée*, is a name now chiefly applied to *Viola tricolor*, and its garden varieties, which are commonly cultivated under the name of HEART'S-EASE. When skillfully managed, they are great ornaments of the flower-beds in a garden, but they are short-lived, and require to be continually renewed by seeds or cuttings. Some consider that the cultivated pansies are hybrids between the wild pansy and other species of *Viola*, such as *Altaica*. Darwin attempted to discover its origin,

but "gave up the attempt as too difficult for any except a professed botanist." Carrière made experiments in sowing seeds of *Viola tricolor*, and came to the conclusion that it was quite possible in time to obtain the garden pansy by careful selection.

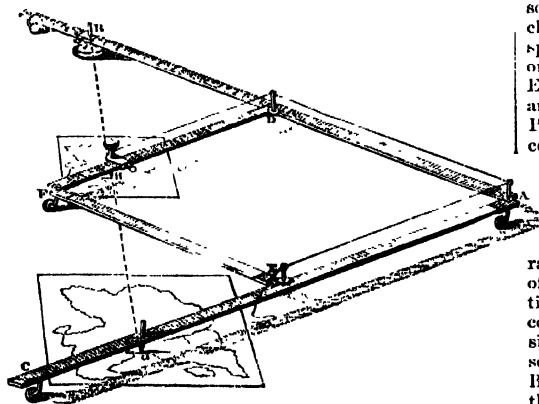
PANTAGRAPH (Gr. *panta*, all things; *graphô*, I draw), an instrument for copying on any desired scale a figure or drawing of any kind. There are numberless varieties of construction, but all depend upon the same principle. If four rods be taken of such a length that



when joined together at A, at D, at E, and at F, A B be equal and parallel to D F, and F E equal and parallel to D A, then however the whole figure is bent, whether close together or wide apart, the sides named above will always be equal and parallel; and further, if at starting the lengths of A B, A C, be such that B, F, and C come in the same straight line, they will always do so whatever the shape of the figure.

It follows from the laws of similar triangles and of parallel lines that if B be fixed (but with full freedom of rotation), any movement of C will be imitated by F on a reduced scale. If, for instance, F be two-thirds the distance from B that C is, then the copy at F will be two-thirds the size of that at C, but exactly similar to it in every respect. C is made to travel over the lines of the map, &c. (B being fixed), and a pencil or marker piercing through F marks down the reduced copy. Of course, a magnified copy is quite as readily produced with the point F as a tracer (B being fixed) and the pencil at C.

The effect is unaltered if instead of the extremities B, F, C, we take other points, B, G, in D, F, A, C, if only care be taken to make the three acting points B, U, G, fall in the same straight line. The facility of adjustment thus gained is



Pantagraph.

valuable, for it is evident that the proportion by which the copy is reduced or enlarged is variable according as we take B (and therefore G) higher or lower on their respective rods. The accompanying illustration shows an improved form of pantagraph used in map-tracing.

PANTALOON' (Fr. *pantalon*, Ital. *pantalone*), the patron saint of Venice, and hence a baptismal name very common among the Venetians, and applied to them in ridicule by the other Italians. The word is derived by some authorities from the Italian *pianta leone*, or "lion planter," the lion of St. Mark being the standard of the Venetian republic. In the ancient Italian pantomime he figured as a Venetian burglar, and in our present Christmas representations appears as an imbecile, good-tempered, and infirm old man, the butt of the clown, whom he nevertheless assists in all his humorous exploits.

PANTHEISM (Gr. *pan*, all, and *theos*, God), a very indefinite term applied to certain systems of thought or theology, ancient and modern, which identify God with the universe. The term itself is comparatively modern, having been first applied as a name in the controversy raised by Toland in the beginning of the eighteenth century, but the mode of thought which it indicates is of very remote antiquity. In all ages of the world it would seem that many thinkers, endeavouring to understand the mystery of being, have been led to pantheistic conclusions, while most of the great religious systems of antiquity are of a pantheistic character. It has been claimed for FETTERISM and POLYTHEISM that they are based upon pantheism, but as a system of thought the latter must be placed as a later development of thought than pantheism. The earliest known form of pantheism as a religion is that which is found in connection with the ancient religion of India as set forth in the hymns of the Rig-Veda. By the Hindu philosophers of that period the universe was regarded as being simply a manifestation of Brahma, produced by the evolution of himself, and that all material things and all spiritual things were merely temporary and evanescent forms of one infinite substance. The Hebrews, so far as the writings of the Old Testament are concerned, do not appear to have conceived of God other than as a personal being, distinct from the universe, his creation; but speculations of a pantheistic character may be found in connection with later developments of Jewish thought. Among the Greeks we find that the fundamental principle of all their chief systems of philosophy was essentially pantheistic, the aim of the philosophers being to discover some one principle to which all modes of manifestation could be referred. In the teachings of some of the Greek philosophers the conclusions arrived at are of a materialistic character, while others proceed to an opposite extreme of spirituality, and refer to matter as an illusion, appearance, or shadow merely of the Infinite Being. The doctrine of EMANATION, in which the universe was regarded as being an effluence of God, was very fully developed by the Neo-Platonists, and their thoughts and speculations exerted considerable influence over the teachings of some of the fathers. In Gnosticism and Manichæism the influence of Greek and Oriental thought is still more manifest. During the early mediæval period ERIGENA, a profound student of Greek philosophy and the writings of the Alexandrians, in his "De Divisione Naturæ," propounded certain doctrines concerning the relations of God to the universe, which practically resulted in identifying God with nature, and though his teaching was condemned by the ecclesiastical authorities, it exerted considerable influence over the subsequent developments of scholastic philosophy. At a later period GORDANO BRUNO reproduced, with some important modifications, the speculations of the Neo-Platonists. It was the fate of this bold thinker to fall into the clutches of the Inquisition, and he was burned at Rome for his opinions; but he must be regarded as the precursor of the modern European pantheistic philosophy, both Descartes and Spinoza being indebted to him. The father of modern pantheism, however, is undoubtedly SPINOZA, who, starting from the principles of Descartes, worked out with wonderful intellectual power

and a rigorously logical process of reasoning, a complete pantheistic system of the universe. But while few would question the definitions and axioms upon which his system is based, and no one can deny the soundness of his reasoning, he has never had any direct followers, and his system, though it has been the subject of earnest study, has never been accepted by any school of philosophy. His teachings, however, although not adopted in their entirety, have greatly influenced the metaphysical speculation of Germany, and most of the short-lived systems of its philosophers have been of a pantheistic character. Pantheism has found some of its greatest and most eloquent expounders in Schelling, Hegel, and Fichte, according to whom the world is not a creation, but a ray or emanation from the infinite mind of God, one intelligence or spirit informing alike the worlds, man, beast, insect, all that is. At the present day few persons accept pantheism, either as a system of philosophy or of religion; but as a sentiment it is found in much of our highest poetry and even theology. Tennyson's lines in his poem, "The Higher Pantheism," are well known:—

"The sun, the moon, the stars, the seas, the hills, and the plains—
Are not these, O soul, the Vision of Him who reigns?
Dark is the world to thee: thyself art the reason why;
For is He not but thou, that hast power to feel 'I am I?'
Speak to Him thou for He hears, and spirit with spirit can meet;
Closer is He than breathing, and nearer than hands and feet."

Mysticism in all ages has ever had a tendency towards a spiritual kind of pantheism, and it is somewhat remarkable that men of a totally different temperament to the mystics, who have developed chiefly the faculties of observation and reasoning, have, as the result, arrived at conclusions of a similar character.

PANTHEON, a celebrated temple at Rome, of which Valerius of Ostia is said to have been the architect. That the portico was erected by Agrippa, the son-in-law of Augustus, is testified by the inscription on the frieze:—"M. Agrippa, L. F. Cos. Tertium Fecit." The Pantheon is by far the largest circular structure of ancient times, the external diameter being 188 feet, and the height of the summit of the upper cornice 102 feet, exclusive of the flat dome, which makes the entire height about 144 feet. The portico, 103 feet wide, is octostyle, but there are in all sixteen columns. The columns are 47 English feet high, with bases and capitals of white marble and granite shafts, each formed of a single piece. The interior diameter is 142 feet, the thickness of the wall being 23 feet through the piers, between the exhedrae or recesses, which, including that of the entrance, are eight in number. The dome has a circular opening in the centre, 23 feet in diameter, which lights the interior completely. The Pantheon was originally dedicated to all the gods, but was consecrated as a Christian church in the seventh century. See **DOME**.

PANTHER. See **LEOPARD**.

PANTOMIME, the name of an ancient species of dramatic performance, in which the actors expressed themselves by gestures. The name is composed of two Greek words, meaning "imitation of everything." Pantomimic acting, accompanied by music, has been in use among the Chinese, Persians, and other Oriental people, from the oldest times. The Greeks introduced the pantomime in their choruses, some of the actors dancing and gesticulating, while others sang. The Romans had entire dramatic representations consisting of dance and gesture only, styled *saltatio pantomimorum*. In modern times, pantomimic ballets representing an entire dramatic action or fable, became a favourite scenic performance. The Tuscan Angiolini, in the last century, and after him Vignano, who died at Milan in 1821, excelled in this species of composition. Noverre, in France, also distinguished himself in the composition of pantomimic ballets, descriptive of serious and even romantic plots.

The name *pantomime* is now commonly applied to the harlequinade theatrical performances exhibited in British theatres at Christmas time. This kind of entertainment came into public favour under the auspices of the Grimaldi family, about 1760. At that time the wit of the clown was the principal feature, but now scenic effects are more relied upon. Enormous sums are annually spent by managers in the preparation of the Christmas pantomimes.

PA'OLI, PASQUA'LE DE, a patriotic Corsican leader, was born in 1726 in the village of Rostino, in the island of Corsica. He was educated at the military college of Naples, and afterwards obtained a lieutenant's commission in the Neapolitan service. In July, 1755, he was proclaimed captain-general of the Corsicans, who had revolted against the Genoese. During twelve years he baffled all the efforts of the latter, who lost every part of the island, except the maritime towns of Bastia, Calvi, and San Fiorenzo. Paoli, after quelling an insurrection of his own countrymen, organized the island, and fixed its government and administration. He formed a legislative assembly; nine members, elected by the deputies, constituting the executive, of which he himself was president, with the title of General of the Kingdom and Chief of the Supreme Magistracy of Corsica.

Genoa, despairing of ever recovering the sovereignty of Corsica, ceded it to France in 1768, and in 1769, after defeating the Corsicans, the French entered Corte, and overran the whole island. Most of the communes submitted to the conquerors. Paoli, with many followers, retired to Portovecchio, from whence he sailed in an English vessel for Leghorn. He afterwards repaired to England, where he remained till 1789, when Mirabeau moved in the National Assembly the recall of the Corsican patriots. Paoli then repaired to Paris, where he was received with acclamations, and in the hall of the Assembly he promised fidelity to France under the new order of things. He was presented to Louis XVI., who made him lieutenant-general and military commandant in Corsica. Paoli acted faithfully towards the constitutional monarchy of France; but after the outbreak of the Revolution he assembled his countrymen, by whom he was appointed general-in-chief and president of the council of government. At the first declaration of war between England and France he applied to the English commanders in the Mediterranean, and with their assistance drove the French garrisons out of the island. Soon after a deputation of the Consulta proceeded to London to offer the crown of Corsica to the King of Great Britain. The offer was accepted, and Paoli returned to England, where he lived in retirement for several years on a pension which the British government allowed him. He died near London, 5th February, 1807.

PA'OLO VERONE'SE, the great painter (1528-88), had for his real name Paolo Caliari, and was called Veronese from Verona, his birthplace. After passing his boyhood and early youth there he migrated to Venice, where he always afterwards dwelt. He was for some time held to be the equal of the young Titian, but eventually the latter soared beyond anything that Paolo could attempt. A journey to Rome opened his eyes to the merits of Raffaele and Michelangelo, and produced a certain alteration in his style. His paintings after his return were so much to the taste of his fellow-citizens that the Doge knighted him. He was held in the greatest esteem till his death, which was mourned as a public misfortune.

While Paolo must be held inferior to Titian, there is no other Venetian painter, not even Tintoretto his contemporary, who can be put upon a level with him. His magnificence of design and colour, his delicacy of chiaroscuro, the light and air and sunny breadth which fill his pictures, the fine architectural backgrounds, the vivid characterization of men and of animals, and the happy grouping of his vast canvases, make him one of the most pleasing and

choicing of painters. "The Marriage at Cana," with portraits of Francis I., of Charles V., and of many other princes and potentates, introduced after the fashion of the time, is usually held to be his finest work. It contains over 120 figures, and measures 30 feet by 20. It is now one of the chief glories of the Louvre at Paris. The best representative picture of the master in England is the "Family of Darius brought before Alexander," which is in the National Gallery.

PAPAL STATES or STATES OF THE CHURCH (Italian *Stati Pontifici* or *Stati della Chiesa*), names given to the dominions belonging to the see of Rome, of which the Pope was the monarch. The last of them were annexed to the kingdom of Italy in 1870, and are now divided into the five provinces of Rome and Comarca, Civita Vecchia, Viterbo, Frosinone, and Velletri. The district occupies the central part of Italy. The total area of the country annexed in 1870 was 4891 English square miles, with a population of 692,106. The territory of the sovereign pontiff, previous to 1859, had embraced the much larger area of 17,218 square miles, with 3,131,668 inhabitants, but three-fourths of this territory was annexed to Italy in 1859 and 1860. The remainder was retained for the Pope by the arbitrary will of France until 1870.

The origin and formation of the Papal States is one of the most obscure and intricate subjects in the history of modern Europe. The Bishop of Rome had a sort of municipal power in the city during the government of the country by the exarchs of Ravenna, and afterwards by the Longobards. In the beginning of the eighth century the Roman citizens, headed by their bishop or pope, rebelled against an edict of the emperor at Constantinople against image worship; and the loose bond which had hitherto attached Rome to the Eastern Empire was dissolved.

Rome now governed itself for many centuries as an independent commonwealth, retaining the title of duchy, having its senate, its consuls, and tribunes. It was soon found necessary to have powerful support from some other quarter; and Pope Stephen III., after having crowned Pippin king of the Franks, at Soissons, in 751, by means of his legate, conferred upon him the title of Patrician of Rome, which was the appellation of the officer who used to represent the Byzantine emperor in the Eternal City.

In return for this Pippin granted to the see of Rome, in 755, the Exarchate of Ravenna and the Pentapolis, which he had conquered from Astolf, king of the Lombards. [See DONATION.] Ravenna, Bologna, Ferrara, and the entire space bounded by Rimini, Ancona, and the Apennines, was included in this splendid gift. The popes, up till then quite inferior in power to the patriarchs of Constantinople, at once became the actual, as they had long claimed to be the titular, heads of the church, though as yet the territories mentioned remained free on condition of paying tribute. Charles the Great, son of Pippin, exercised full patrician (kingly) rights over Rome, and seemed disposed to minimize the territorial control of the Roman see over the states given by his father. He was met by the production of the famous forged Decretals of the early popes, containing the alleged DONATION OF CONSTANTINE, giving over to the see of Rome the city and the whole of Italy (*urbem Romam et totius Italiane civitates*); whereupon Charles gave way, and received as the price of his confirmation and extension of the donation of Pippin the title of Emperor of the Holy Roman Empire, and was crowned as such at Rome, by the hands of the Pope, on Christmas Day, 800. The emperor, Henry III., gave the church the Duchy of Benevento in 1053, and some portions of Charlemagne's gift had also been by that time brought into closer connection with Rome.

The *patrimony of St. Peter*, as it is called, Modena, Parma, Mantua, and part of Tuscany, a vast tract of splendid territory, was given over to Rome by the famous

Countess Matilda in 1102. On her death, however, the Emperor, Henry V., claimed her estates as a lapsed fief, and proceeded to occupy the greater part of them, notwithstanding the claim put forward by the Pope on the strength of the countess's will (1116). Some portions of this splendid gift were, however, acquired by Rome. The famous Concordat of Worms (1122), by deciding the question of Investiture substantially in favour of the popes, implicitly declared the independence of the papal see. The dictation so freely exercised by Charles the Great, Otto the Great, and even Henry III., was for ever lost to the empire.

Freed at last from imperial control the popes rapidly gained in temporal power. Innocent III. made the first great advance by seizing Spoleto and the Marches in 1198. The whole energy of the popes was now directed towards converting their shadowy rights into actual sovereignty; and every art of diplomacy, legal or illegal, was employed in turn. In the long contest with Frederick II. the whole of the patrimony of St. Peter, much of which had been painfully brought under, was taken possession of by the emperor, and a great part laid waste; but the limits of this papal territory were defined, and all imperial rights over it were abandoned to the Pope by the Emperor Rudolf of Hapsburg in 1278. By this splendid diplomatic victory Nicholas III. found himself nominally lord of Benevento, Spoleto, the Marches and Ancona, Ravenna and the exarchate, Bologna and Perugia. Forli and the rest of the Romagna were added in 1297. Much of this large extent of papal government was lost during the Avignon exile (1301-71), and a number of petty principedoms and semi-independent states arose. The warlike Cardinal Albornoz regained many towns for Innocent VI. in 1353; Bologna fell in for a time also, in 1364; and Cesare Borgia, in 1500, reconquered for his father, the infamous Alexander VI. (Borgia), the whole of the Marches. The next great acquisitions were those of the warrior-pope Julius II., who from 1503 to 1510 brought nearly the whole of the Romagna, with Bologna and Perugia, Parma and Piacenza, under the entire temporal sovereignty of the Roman pontiff. Parma and Piacenza were given by Paul III. to his son, Duke Pietro Luigi Farnese. Additions were now made rapidly; Ferrara and the rest of the Romagna, possessions of the house of Este, were seized by Clement VIII. in 1598. Urbino was acquired in 1626, and the Duchy of Castro and Orvieto in 1650. Thus the great fabric of the papal temporal sovereignty was completed.

In 1797 Napoleon Bonaparte, then a general of the French Republic, forced the Pope to give up all the four legations (Bologna, Ferrara, Ravenna, and Forli), which he annexed to the Cisalpine Republic. The whole state was seized by his army in 1798, but restored to Pius VII. (except the legations) in 1801. The Marches of Ancona were next torn away, to form part of the new kingdom of Italy in 1808, by Napoleon, now emperor, and Rome and the southern territories were formally annexed to the French Empire in 1809. The whole of the Papal States were finally incorporated with the kingdom of Italy in 1810. The congress which met at Vienna in 1815 restored the greater part of them to the sovereign pontiff; but the clerical misgovernment contrasted so strongly with the liberal rule of France, that the people several times rose in rebellion, and were only kept down by foreign intervention. On the accession of Pope Pius IX. to power in 1847, he established a constitutional Parliament, consisting of ninety-nine deputies, popularly elected; but alarmed at the spread of revolution in various parts of Europe in the following year, he halted in his liberal career at a most critical moment, whereupon the people rose in rebellion, drove him to Gaeta, and proclaimed Rome a republic. Pius was restored through the intervention of Austria, Spain, Naples, and France.

The government of the Papal States, previous to the accession of Pius IX., was wholly ecclesiastical, no person being eligible to fill a public office who had not obtained the rank of abbot. After the year 1847, however, many important official positions were thrown open to the laity. In theory, the sovereign pontiff enacted all laws and nominated to all appointments; but practically the legislative and executive power was left to a cabinet, differing little in respect to its organization from other European governments, except that the head of each department was generally a cardinal, and there was nothing to correspond with the English system of popular representation. There were civil and criminal courts in all the provinces, with courts of appeal in the chief cities, and a central tribunal in Rome. All the proceedings were public except the trials for political offences; but there was good reason to believe that great abuses existed in all departments of the administration.

France maintained a strong garrison in Rome from 1849 to 1866, for the purpose of preventing any further risings there. In 1860 the inhabitants of the Romagna—four legations to the north of the city which had been kept in subjection solely by the presence of Austrian troops—took advantage of their withdrawal to throw off the papal authority and annex themselves to the kingdom of Italy. In 1866 the French garrison was withdrawn from Rome, under the terms of a convention which had been entered into between the King of Italy and the Emperor of the French in 1862, by which the former undertook not only not to attack the territory of the Pope, but to prevent by force, if necessary, any attack being made upon it from the exterior by others. In the spring of the following year, however, General Garibaldi commenced making preparations with the object of making Rome the capital of Italy, and the signal for the outbreak was given in September. The Italian government was unable or unwilling to check the progress of the insurgent bands, but the French hastily despatched an expedition from Toulon for that purpose. At the end of October Garibaldi defeated the papal army at Monte Rotondo, but on the approach of the French troops he was marching in the direction of the frontier, when on the 3rd of November he was attacked by a combined French and papal force, and his half-armed force, after a gallant resistance, was defeated with heavy loss. The French government afterwards pledged itself to a perpetual guarantee of the papal possessions, without imposing on the Holy See conditions of any kind.

Very soon after the outbreak of the war between France and Germany, in 1870, the French troops were, however, obliged to be withdrawn, and the opposition in the Italian Parliament at once attacked the convention of 1862. Early in September the exigencies of the situation became more than ever pressing. Napoleon III. had been compelled to surrender, and was unable to maintain his part of the convention of 1862. Republican agitation seemed likely to upset the Pope altogether. It was impossible for the King of Italy to maintain his present position; he must either obey the current of public opinion, which tended irresistibly towards Rome, or let his imperfectly compacted dominion fall to pieces, and Rome, and Italy too, be given up to anarchy. He decided on the former course, and his army, under General Cadorna, crossed the frontier.

The Italian army marched on Rome, and were received everywhere with open arms. On the 16th they entered Velletri. A flag of truce sent to Rome was ill received, and after an ineffectual attempt by the German ambassador to persuade the papal garrison to open their gates the attack commenced. In spite of the Pope's orders, that no real resistance should be made, a cannonade of four hours was found necessary before General Cadorna, on the 20th of September, succeeded in entering the city by a breach. The losses on either side, however, were insignificant. After settling the terms of surrender with

General Kanzler, the whole army entered, and was very warmly received by the citizens.

In order to unite Rome with the rest of Italy, and make it the capital of the kingdom, with a fair show of popular and moral sanction, it was decided to appeal to the will of the people throughout the States of the Church by a plebiscite. The voting on the 2nd October was almost unanimously in favour of the king, and on the 11th General La Marmora arrived to assume the government of the city, with a council, in his sovereign's name.

The Pope was guaranteed his sovereign rights, allowed to retain his guards, and granted an income of 3,225,000 francs. He was also allowed to keep the Vatican, the Church of Santa Maria Maggiore, the country seat (among the Alban Hills) of Castel Gandolfo, and their dependencies, which were exempted both from taxes and common-law jurisdiction, and even in pursuit of criminals neither visits nor searches were to be allowed. The Pope might prefer to benefices without royal permission, and the seminaries and other Catholic institutions would derive their authority from the Holy See alone, without any interference from the Italian scholastic authorities.

PAPAVERA CEE, so called from the genus *Papaver*, form a small order of *POLYETALÆ*. Their active qualities are usually deleterious, but are for the most part of little moment, except in the case of the *Papaver somniferum*, or Opium Poppy, the properties of which have been already noticed. *Sanguinaria canadensis* is the Blood-root of North America; the root has red juice, and is used for its emetic and purgative properties. Celandine (*Chelidonium majus*) is common in this country; its yellow juice is acid and poisonous. The Yellow-horned Poppy (*Glaucium luteum*) is found in abundance on our sea shores.

The plants belonging to this order are herbs with regular or (in *Fumariacæ*) irregular flowers, which have two caducous sepals, four petals (rarely six); four or numerous stamens; ovary syncarpous, one-celled, with two or many parietal placentas, and one or several seeds. See *ORIFORM*.

PAPAVERINE, an alkaloid found in opium. It is a crystalline base insoluble in water, but soluble in boiling alcohol and ether. The formula is $C_{20}H_{21}NO_4$. It is distinguished from other opium alkaloids by the formation of a deep blue colour with strong sulphuric acid. It is not poisonous. It forms a number of salts with acids, not very definite. It is used in medicine as a narcotic in doses of one-twelfth to one-third of a grain, and is said to produce no excitement nor giddiness.

PAPAW-TREE (*Carica Papaya*) is a native of tropical America, but cultivated throughout the tropics. The fruit is of an orange colour, succulent with an acid juice; it can be eaten raw with pepper and salt, but is usually cooked. The tree grows from 20 to 30 feet in height; the timber is of no value as it is soft and spongy, but the tree possesses the remarkable property of rendering newly-killed meat tender when suspended among its branches. Dr. Seemann in his work on the Fiji Islands ("Viti") says—"Only a few seem to be aware that saponaceous properties reside in the leaves, which in the absence of soap may be, and in tropical America are, turned to advantage; that both the leaves and fruit act in a hitherto unexplained way upon the animal fibre, and make the toughest meat tender, if either boiled with portions of them, or even wrapped up in the leaves; that the fruit is very good eating either raw or boiled; and that the seeds, distinguished by a mustard-like pungency, are an efficacious vermifuge."

Carica belongs to the group *Papayacæ*, formerly classed as a distinct order, but placed by Benthams and Hooker in the order *PASSIFLOREÆ*. In this genus the male and female flowers are generally on separate trees; the males have a funnel-shaped corolla with ten stamens in two rows, while the females have a corolla of five distinct petals.

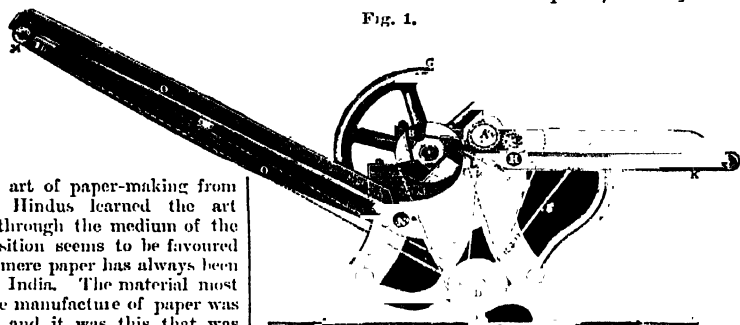
PAPER. In early times the materials used for writing were chiefly such as only required some little mechanical fashioning to fit them for that purpose. Smooth flat stones, boards, plates of metal, dried leaves, strips of bark, skins and intestines, flat bones, plates or cylinders of clay afterwards hardened by baking, were all pressed into service, while in Egypt the pith of the papyrus reed was employed for so long a period that it gave a name to writing material which has been retained to this day. At a later date parchment was prepared for writing, and ultimately the art of making paper from fibrous matter reduced to a pulp in water was discovered by the Chinese. The date at which this discovery was made is uncertain, but by some writers it is traced back to the second century B.C. Among the Hindus it appears the materials originally used for writing were dried leaves and bark, but the plants from which these were first taken it is impossible now to determine. It is clear, however, that for the past twelve centuries three species of palm—viz. the *Borassus flabelliformis*, the *Corypha taliera*, and the *Corypha elata*—have yielded the bulk of the writing material for the Hindus. Before that the inner bark of the bhrj tree (*Pectula bhijapatra*) was most in use, and allusions to it are to be found in works 2000 years old. The early Aryans in their settlements in the Punjab and along the foot of the Himalayas, must have found this material ready to hand, and employed it for various purposes of domestic economy as well as for writing. It is still used for writing amulets on account of its lasting quality, for though thin and fragile to look at, it will endure for centuries without decay; in one instance a piece of bhrj bark about 2000 years old was found in the sanctuary of a Buddhist tope. Simultaneously with leaves and bark, the Hindus used paper for writing for many centuries. Block printing on paper was practised in Tibet in the sixth or seventh century of the Christian era, and in Cashmere the use of paper and papier-maché were became common about the same period. It seems probable that the Tibetans must have learned the art of paper-making from the Chinese, and that the Hindus learned the art from them, either directly or through the medium of the Cashmiris. The latter supposition seems to be favoured by the circumstance that Cashmere paper has always been held in the highest esteem in India. The material most favoured by the Chinese in the manufacture of paper was the wool of the cotton plant, and it was this that was most generally used throughout Asia. After the capture of Samarkand in 704 A.D. by the Arabs, the manufacture of paper was taken up by them, and soon spread throughout all parts of their then rapidly extending empire. Some Arab paper MSS., dating from the ninth and tenth centuries of the Christian era, are preserved in the libraries of Europe, one dating from the year 960 A.D. being preserved in the British Museum. As a valued article of commerce, the paper manufactured by the Arabs was imported into Europe, while the Moors in Spain established important factories at Xativa, Valencia, and Toledo. As the manufacture moved northwards, and raw cotton became difficult to procure, rags were employed as a substitute, rag paper being made as early at least as the middle of the twelfth century. Linen paper was not made until the fourteenth century, but once introduced its superiority over cotton paper was quickly manifested. It is uncertain when the manufacture of paper was introduced into England, though its use for writing purposes can be shown from existing MSS. to have been known as early as 1309. A person of the name of Tate is said to have had a paper-mill at

Hertford early in the sixteenth century; and another is stated to have been established in 1588 at Dartford in Kent, by a German, who was knighted by Queen Elizabeth. Great improvements were introduced in the manufacture by Thomas Watson in 1713; but it was not till recent times that the manufacture reached any high degree of excellence.

In the making of paper any fibrous vegetable substance may be used, such as bark, stalks, tendrils, hopbine, and wheat straw. Nothing, however, has yet been found to answer so well as linen, hempen, or cotton rags. Of other materials the more important are ESPARTO GRASS, a description of which has already been given under that heading; straw, which is extensively used both in Great Britain and America; and wood, which is used on the Continent and in America as well as in England. In Japan the bark of the paper mulberry (*Broussonetia papyrifera*) is the material chiefly employed. In all kinds of paper-making, whether from the bark of trees or other fibrous matter, or from rags, the general process is the same. The fibrous material is cut and bruised in water till it is separated into fine and short filaments, and becomes a sort of pulp. This pulp is taken up in a thin and even layer upon a mould of wire-cloth, or something similar, which allows the water to drain off, but retains the fibrous matter, the filaments of which are, by the process of reduction to pulp and subsequent drying and pressing, so interwoven or felted together that they cannot be separated without tearing, and thus form paper.

Paper manufacture involves two distinct sets of operations—(1) the making of the pulp, and (2) the making of the paper from the pulp. For the first of these operations, when rags are used, the first business is to sort them, and the next to cut them into small pieces, either by hand or

Fig. 1.

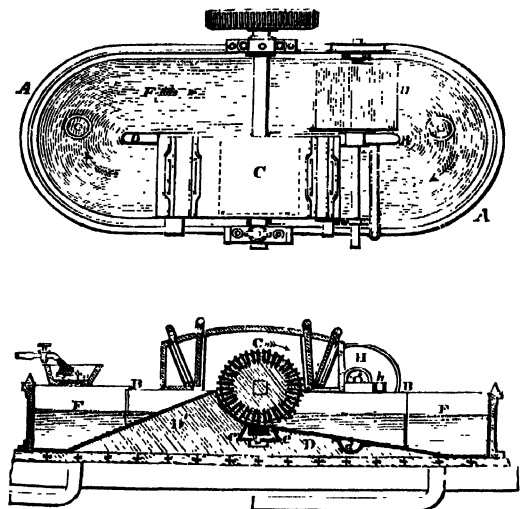


by machinery. Mechanical rag cutters of various forms are in use. Fig. 1 represents a cutter provided with a feed roller, A, 4 or 5 inches in diameter, and provided with conical pins over its surface. The revolving knives are of cast iron, and are permanently fixed in the frame, B. They pass in their rotation close to the projecting steel lip, C, and they remain sufficiently sharp; it is therefore only necessary to advance them from time to time by means of the set screws shown in the figure. Motion is communicated to the shaft D, and this causes the shaft E to rotate, as well as that carrying the cutters and a small roller, M, which gives motion to an apron in order to convey away the cut rags; F and G are provided with cone pulleys, in order to regulate the rate of feed according to the nature of the rags under treatment; H communicates its motion both to A and to the apron, I K, by which the rags to be operated upon are introduced.

The cut and sorted rags are then exposed to the action of a *dusting* machine, by which the whole of the loose dirt is removed, and they are then boiled for ten or twelve hours in a solution of caustic soda, to remove grease, &c. After

a further washing in cold water, they are passed on to the rag engine. This consists of an oblong trough, *A A*, fig. 2, with rounded ends, partially divided by a partition in the centre, *B B*, which rises up from the bottom, but leaves the ends of the trough free, and fitted with a revolving cylinder, *C*, the surface of which is furnished with a number of sharp blades or cutters, which are so placed as to act against other cutters, *e e*, fixed beneath the cylinder.

Fig. 2



The fixed blades make a small angle with the axis of the cylinder, and the distance between the two sets can be adjusted, by the aid of levelling screws, according to the degree of fineness desired in the resulting fibre. The cylinder, rotating in the direction of the arrow with a velocity of about 230 revolutions per minute, causes the water and rags to circulate in the engine, and the latter are necessarily subjected to the action of the blades. As a very thorough washing of the rags takes place, it is essential that fresh water be constantly supplied; the dirty water is, at the same time, removed by an arrangement which varies at different mills. Sometimes a cylinder, *U*, is arranged in the portion *r u* of the trough, and is caused to rotate either by the current of water or by gearing. When driven by gearing, it is formed of two discs of wood or copper, and covered with fine gauze, which allows the water to enter, but keeps back particles of the fibre. A number of buckets within this cylinder conduct the water to a trough in the axis of the drum, by which it is led away. The whole can be raised out of the vat when, as is the case in certain parts of the process, the removal of liquid is not required, or its height in the pulp can be varied at pleasure. The peculiarly shaped elevation, *u u'*, only exists at the side of *B B*, at which *C* revolves, and is technically termed the *mid-feather*; a trough, *d*, is usually cut in it, which is covered with a lattice, and is for the purpose of retaining sand and other heavy bodies.

The engine is half filled with water and packed with the boiled rags, and the cylinder *C* being set in motion, the latter are, in an hour or two, reduced to pulp. A solution of chlorine, prepared from hypochlorite of lime, acidulated with sulphuric acid, is then introduced, and the engine is worked again for one or two hours, after which the pulp is run into vats and allowed to settle, until it is sufficiently bleached. This bleached pulp is then subjected a second

time, and for a much longer period, to another beating engine, called a *poacher*, and during this period it is washed quite free from the bleaching agent; the last traces of this may be neutralized by the use of a sulphite or hyposulphite of soda, and the loading material of china clay or pearl white is added. The next process is sizing, which, in the case of engine sizing, is carried out by the introduction of a mixture of resin soup treated with alum into the pulp while it is in the beater. During this process, also, any colouring matter that may be required is introduced, a little cochineal, ultramarine, magenta, or aniline blue being necessary even for *white* paper. Ultramarine is generally used for blue papers, and aniline colours are very generally employed where tinted paper is required.

The pulp, or *stuff*, as it is technically called, is now ready to be made into paper, which is done either by hand or by machine. In the hand method the sheet of paper is made by a mould, composed of a frame covered with fine wire-cloth, having a movable edge called a *deckle*. This mould the workman dips into the vat containing prepared pulp, lifting a portion of the pulp on its surface. The water flows through the wire-cloth, and leaves the fibre on the top. The workman then removes the deckle, and passes the mould to another, who turns it over and presses it on a felt, to which the sheet adheres; the mould is then returned to form a new sheet.

About 130 sheets are laid in alternate layers of felts and sheets, and the whole submitted to powerful pressure. The sheets are then taken out of the felts, and being laid together, are subjected to another pressure, after which they are parted or turned over, to prevent their adhering to each other. The paper is then taken to a drying house, and hung up on lines to dry. It is next sized, gently pressed, and the sheets parted from each other and hung up a second time to dry in a loft or drying house.

Various wire marks, or water marks, as they are called, are applied to paper to distinguish it. Hand-made paper is also commonly marked with the name of the maker, and the date of the year when it was made. Formerly the devices employed by manufacturers to distinguish their paper were curiously absurd. Some of the names now in use were derived from them. A jug or pot was put on paper of a small size; hence it still retains the name of *pot*. Another device was a fool's cap and bells; hence the name *foolscap*. And *post*, in like manner, is supposed to have been so called from the very common device of a post-horn.

The idea of substituting machinery for hand labour in paper-making is due to Louis Robert, who contrived the first machine in 1799. M. Didot and Mr. Gamble introduced it into England, and, allied with Messrs. Fourdrinier, commenced the great work at Mr. Hall's engineering establishment, Dartford, Kent, where various improvements were applied by the inventive genius of Mr. Donkin.

Modern Paper Machine.—The preparation of the pulp having been completed in the beating engine, it is all collected in the stuff chest or reservoir in a condition to be delivered to the machine as required. The stuff chest is formed of wood or iron, and is usually capable of containing 1000 to 1200 lbs. of pulp. Within it a vertical shaft, carrying two horizontal agitating arms, each extending nearly across the vat, rotates from one to three times per minute, according to the quality of the pulp. An important desideratum in paper is uniform thickness, and this can only be obtained by a regular supply of pulp of uniform consistency.

The pulp, on leaving the stuff-chests, passes through the regulating box, an appliance which has the effect of keeping a regular supply of pulp on the machine; and when it has been delivered by the stuff pumps, is mixed with a certain quantity of water drawn from the pulp immediately preceding it, and this mixture is then made to pass along

sand-tables, or *sand-traps*, in order to free the stuff from any gritty matter which may accompany it from the beating engines. From then the pulp passes into the *strainer*, or *knottng machine*, an appliance which was invented by Ibotson, an English papermaker, in 1830. By its means the knots or impurities are removed from the paper stuff or pulp.

The pulp is delivered from the sand-tables into the patent knotter, whence it passes into three vats containing square revolving strainers, each of which has its four sides covered with brass strainer plates perforated with extremely fine slits. The strainers, which are caused to rotate by suitable gearing, contain india-rubber bellows, or a perforated suction pipe, and the fine pulp is thus drawn within the strainers, all knots, &c., remaining in the vat. The purified pulp then passes out through a hollow bearing at the opposite end of the strainer to the piston, and its escape is so regulated by a sluice as to keep the pulp in the vat at a height suitable for the working of the revolving strainer. Three such strainers are shown in Plate.

The pulp on leaving the strainer passes into a vat containing a horizontal agitator or *hog*; here it is properly mixed and made ready to flow on to the endless *wire-cloth*. It is so supported by brass tube rolls as to render the layer of pulp absolutely uniform, thus insuring a constant thickness in the finished paper. The meshes of these wire-cloths are extremely fine; in some cases there are as many as 19,000 holes per square inch; but the principal meshes employed are from 2000 to 6000 per square inch, and the ends are united so as to form one continuous sheet.

Below the tube rolls is the *save-all*, a shallow box which receives the water as it flows through the wire-cloth from the pulp; for a large quantity of water is necessary in order to float the pulp along the sand tables, through the strainers, and on to the wire cloth. The pulp being partially freed from water, a slight side shake is communicated to the wire frame for the double purpose of getting rid of water and weaving the fibres of the pulp together before the water has to any great extent left it, the *deckle straps* keeping the pulp to the width required by forming ledges near the sides of the web. These bands or decks are usually made of vulcanized india-rubber. They travel along with the wire, one on each side, and by their flexibility remain in contact with it, keeping the sheet any required width.

Travelling with the wire, the pulp passes to the *dandy roll*, which is simply a cylinder, the two ends of which consist of brass hoops fixed on a shaft, and having wires extended between them. It is sometimes formed of perforated copper, and is covered with fine wire-cloth. It corresponds in length to the width of the wire upon which it rests. The journals of this roll turn in slits in two upright stands, one behind the machine frame and the other in front of it; but, as the roll actually rests with its whole weight on the wire, it revolves by the progressive motion of the latter, while the stands prevent it from participating in the lateral motion. This roll, by running on the surface of the pulp, presses out a great quantity of water, and renders the paper finer and closer in texture. It is also by this part of the mechanism that the water mark and the lined appearance which paper often presents are impressed.

Beneath the dandy roll, and across the machine, two *suction or pump boxes* are placed, open at the top. As the wire travels over these boxes, the action of the pumps with which they are connected draws the wire upon them with a pressure sufficient to make them air-tight, thereby extracting a large portion of the water which the pulp at this point still retains, and giving to it such a degree of consistency as fits it to bear without injury the pressure of the couch-rolls. The water so extracted, together with that collected in the *save-all*, is added to a fresh supply of pulp before it traverses the sand-tables.

The web of paper now arrives at the *couch-rolls*. These are two large rollers usually of brass covered with felt. The under one revolves inside the wire, and gives the motion to it; the upper rests on the lower, and thus both wire and web of paper pass through between them, receiving a gentle pressure which renders the paper still more compact, forcing out more of the water in it. At this point the paper leaves the wire, and is received on a soft woollen blanket, or endless web of felt, revolving continuously on rollers. This endless web carries the paper between two heavy iron rollers, called *press-rolls*, which still expel a quantity of water. The paper can now bear its own weight, and may be handled gently with impunity. The sheet then passes through the second set of press-rolls; but in order to bring the under side in contact with the upper press-roll, it will be seen in Plate that the paper is inverted by being caused to pass underneath the second set of rolls, and thus these rotate in the reverse direction. This second set of rolls is provided with an endless felt of its own, which, however, is usually made thicker and stronger than that employed in the first press-rolls. Both felts are guided through their respective sets of rolls by means of the *felt-rolls*. It should be added that modern experience shows it to be better to work with all the above-named rolls cold, and not to heat them, as was formerly the practice. In some mills each press-roll is provided with an arrangement for preventing the web of paper from adhering to the metal, and so passing round and increasing the diameter of the roll. These are known as *doctors*, and consist of strips of metal, or preferably vulcanite, held against the rolls by levers and weight, in such a position as to scrape the surface of the roll. The paper now passes to the drying cylinders. They are each about 4 feet in diameter, and, being eleven in number, afford a very large amount of drying surface; for it is essential that this operation be conducted gradually, especially at its commencement. Three of the first section of cylinders, having no felt on them, allow the moisture coming from the paper to escape freely; but the next five cylinders are provided with felts, which hold the paper against the heated surface, thereby smoothing and flattening it, and so making it the more fit for introduction between the smoothing rolls. These are highly polished cast-iron rolls, heated by steam; and as the paper reaches them in a slightly moist condition, they cause its surface to assume a fine smooth appearance. The paper now passes over the three last cylinders, all provided with felts, to render the contact perfect, and thus dry up any remaining moisture.

On leaving the cylinders the web passes through a number of rolls, the surfaces of which are very highly polished. In the machine shown in our Plate they are arranged in four sets of three, but the exact system adopted is immaterial. The object of these calender rolls is to impart a finished glazed surface, the amount of this glazing, of course, depending on the number of rolls employed. From the calender rolls the web is led to the *reels*, which are made of wood, and when an empty reel is placed in the machine it is caused to rotate with a greater circumferential velocity than that at which the paper is delivered, in order that a solid roll may be formed. To prevent the tearing of the paper owing to this extra velocity, a delicately-arranged *slipping motion* is introduced, and this being adjusted when the filling of the reel commences, the strain on the paper remains constant throughout the entire process. Provision is made on the machine for accommodating two reels, so that when one is full the other can be at once brought into action. In this way a continuous web or roll of paper one, two, or more miles long, can be obtained, and now most of the important daily journals are printed from webs of paper of this description. Where the paper is wanted in the form of sheets it is cut by

machinery into the size required, one machine being capable of cutting eight or more sheets at one time to the required size.

Of late years various substances have been tried as a substitute for rags in the manufacture of paper, and some have attained a considerable degree of credit. The Spanish grass known as *Esparto* is very largely used in Great Britain. It was first introduced at a mill near Dublin in 1853, and began to be employed on the Tyne about 1860. In 1856 only some 40 tons were imported into this country. Now the imports have risen to more than 200,000 tons, owing to the successful method of converting it into pulp devised by Mr. Robert Routledge. The treatment of *Esparto* is practically identical with that of straw.

The idea of manufacturing paper from straw dates from the beginning of the present century, and so far back as 1800 a book was printed on straw paper made at the Neckinger Mills, Bermondsey, by a Mr. Matthias Kooops. Various attempts have since that time been made to perfect the fabric thus obtained, but it was not until the year 1852 that the manufacture was fairly started in this country.

The process most generally followed at the present day in the preparation of pulp from straw, is to boil it under high pressure with a solution of caustic soda varying up to 15 per cent. of real caustic. It is then washed and bleached in the ordinary way. Straw pulp does not possess sufficient tenacity by itself for the purpose required, and hence it is mixed with a certain proportion of rag or *esparto* pulp before it is made into paper.

A material which has been very extensively introduced of late years is the fibre derived from wood by one or other of two methods of treatment. The manufacture has made, of late years, remarkable progress, and the paper produced has been considerably improved in colour and texture. White pine and poplar are the woods most generally utilized, and the process consists in the reduction of the wood to a fine fibrous condition by means of millstones, and for the better classes of paper by chemical treatment. The earliest chemical method adopted to remove the substance which binds the fibres together, and the lignine which makes them rigid, consisted in boiling the wood with about 20 per cent. of real caustic soda, under a pressure of from ten to fourteen atmospheres, and this process is still extensively employed on the Continent and in America. It is attended by the weakening, and to some extent the browning, of the fibre thus treated. During recent years certain other processes, in which the pulp is treated by bisulphate of lime, bisulphate of magnesia, &c., have been introduced. A more recent modification is the treatment of wood with concentrated sulphurous acid under pressure.

In addition to the materials referred to, the waste of jute is largely used in the manufacture of coloured papers, and in Louisiana the conversion of the waste sugar-cane or bagasse into paper promises to become a flourishing industry. The high cost of the raw material used at present for the manufacture of paper has given rise to a large number of experiments in the way of converting other vegetable fibres into pulp for this purpose. In China the most common plants have long been employed in making paper, and it has been proved by experiment that the lime tree, common nettle, rush, pine, common heath, common whin, bilberry, &c., in England are all capable of being adapted to a similar purpose. Paper has also been prepared from disgrass brought from North Africa, from the leaves of the dwarf palm, from pine-apple leaves, from the stalks of the hop plant, from peat, from potato stalks, and many other sources, but none of these have obtained any commercial importance.

In the International Exhibition at Paris in 1878 no less than 535 firms of paper makers, including most of

the leading houses of Germany, Austria, England, France, Belgium, Holland, Denmark, Sweden, Russia, Italy, Switzerland, and the United States, were represented. Besides every variety of writing and printing paper, there were special departments for paper-hangings, paper blinds, and paper for building purposes, the general applicability of the material being also demonstrated by the erection of a paper house in the court-yard, with tables, chairs, chandeliers, and stoves of the same material. Since this exhibition many new uses for paper have been discovered, some of them being of a very remarkable character. Thus in the United States the Observatories of Columbia College, New York, the Troy Polytechnic, West Point, and Beloit College have been fitted with paper domes, which, though light enough to be turned by the hand, are said to be as stiff as sheet iron. It has also been used in America in the manufacture of canoes, barrels, and railway wheels, many advantages being claimed for the use of it for the latter purpose. By treating paper with a solution of cellulose in ammoniacal solution of oxide of copper, it is rendered waterproof, and this material has been introduced commercially under the name of Willesden paper.

The Japanese utilize paper to a wonderful extent in the manufacture of toys, lacquer-ware, and such articles, for example, as the imitation of stamped and embossed leather. In short, to touch on the numberless purposes to which paper has already been applied, would greatly exceed the limits of our space; but from the examples referred to a very important future may undoubtedly be augured for this useful material.

The following is a list of the principal sizes of writing and printing paper. In a few cases there are two sizes in use, and both are given. Formerly they were regulated by a fixed and uniform standard, from which the excise allowed no deviation; but since the repeal of the paper duty in 1861, and the removal of government interference, some manufacturers have adopted sizes of their own:—

	Inches.
Pott,	12½ by 15
Foolscap,	10½ " 13½
Post, 18½ by 15½ or	19 " 15½
Copy,	20 " 16½
Large post,	20½ " 16½
Medium post, 18 by 23 or	18 " 22½
Sheet and third foolscap, 21½ by 13½ or	22½ " 13½
Sheet and half foolscap,	25 " 13½
Double foolscap,	27 " 17
Double pott,	25 " 15
Double post,	30½ " 19
Double crown,	20 " 30
Demy—writing,	20 " 15
Demy—printing,	22½ " 17½
Medium demy—writing,	22 " 17½
Medium demy—printing,	23 " 18½
Royal—writing,	24 " 19
Royal—printing,	25 " 20
Super-royal—writing,	27 " 19
Super-royal—printing,	21 " 27
Imperial, 80 by 22 or	30½ " 22
Elephant,	28 " 23
Atlas,	34 " 26
Columbier,	34½ " 23½
Double elephant,	26½ " 40
Antiquarian,	53 " 31

The following is a list of coarse papers, such as gray and brown:—

	Inches.
Kent cap,	21 by 18
Bag cap,	19½ " 24
Havon cap,	21 " 26
Imperial cap,	22½ " 29

	Inches.	
Double two pounds,	17 by	24
Double four pounds,	21 "	31
Double six pounds,	19 "	28
Middle hand,	21 "	16
Lamher hand,	19½ "	22½

Of purples there are—

Copy leaf,	16½ "	21½
Powder leaf,	18 "	26
Double leaf,	16½ "	23
Single leaf,	21½ "	27
Lump,	23 "	33
Hambrø,	16½ "	23
Titter,	29 "	
Prussian, or double lump,	32 "	42

The different varieties of paper may all be classed under four heads, namely, white paper, gray and brown paper, coloured paper, and pasteboards of all kinds.

White paper includes two kinds, writing and printing, of which there are numerous different qualities. Of the former, the best known by name are, in colour, cream, blue, and yellow; in texture, laid or marked by wires crossing each other at right angles in the frame, and wove, that is, made on a frame covered with fine wires woven into a whecloth.

Cream is as nearly as possible a pure white. Writing is always shown to most advantage on this colour, but it has the defect of being more transparent than any other hue; and this transparency is increased by its high finish. The purity of the tint may be improved by the addition of a small quantity of ultramarine and rose-pink.

Blue is a fine shade, and not too transparent. It is obtained by mixing ultramarine with the pulp.

Yellow is simply a bluish shade given by using a smaller quantity of ultramarine than for blue; generally about a fourth or fifth part.

The kinds of gray and brown paper used for wrapping are extremely numerous, and the varieties of coloured paper are almost endless.

The standard quantity in a ream of printing paper is 480 sheets, but paper is often put up with 500 sheets in the ream, and sometimes 516, and even 528. In retail operations the quire contains twenty-four sheets, and the ream twenty quires.

PAPER COAL is a variety of **LIGNITE** capable of being split into very thin layers. It often represents an accumulation of leaves.

PAPER MONEY is a general term covering instruments of exchange, and applied especially to government bank-notes, exchequer bonds, &c. The bank-notes of private banks, and even commercial bills of exchange and promissory notes, are usually held to come under the denomination. The advantages of portability, of economy of time in counting, &c., of security both in keeping and in tracing if misused, of saving in wear and tear of valueless paper as against valuable metal, and saving in interest from a similar cause, are patent upon the first glance.

But paper money only passes for its nominal value when *convertible*. A bank-note, a due bill of exchange, an exchequer bond or Treasury bill, must be paid immediately on demand. If not it at once falls greatly in value. Under pressure government obligations are sometimes made *inconvertible*, and to keep up their value are made by law a legal tender, thus constituting a *forced paper currency*. What becomes of a forced paper currency if the strain is long continued is exemplified in a startling manner in the article **MANDATS**.

PAPER MUL'BERRY, a tree from the inner bark of which the Japanese and the Chinese manufacture a kind of paper, and the South Sea Islanders the principal part

of their clothing. *Proussoutia papyrifera* is the name given to this tree by botanists. It is a small tree, about 20 or 30 feet high. The flowers are unisexual; the male flowers are in catkins, each with four stamens and a four-lobed calyx; the female flowers are on separate trees, arranged in globular heads, each with a three or four-lobed calyx, a single lateral style; the fruit is something like the mulberry, to which indeed the plant is nearly allied. The genus belongs to the **URTICACEÆ** or Nettle family. Dr. Seeman ("Viti") says, that in Fiji, "for the purpose of making cloth it is not allowed to become higher than about 12 feet and about 1 inch in diameter. The bark, taken off in as long strips as possible, is steeped in water, scraped with a conch shell, and then incinerated. In this state it is placed on a log of wood, and beaten with a mallet, three sides of which have longitudinal grooves, and the fourth a plain surface. Two strips of tapa are always beaten into one with the view of strengthening the fibres—an operation increasing the width of the cloth at the expense of its length. Most of the cloth worn is pure white, being bleached in the sun as we bleach linen; but printed tapa is also, though not so frequently, seen, whilst that used for curtains is always coloured."

PAPER NAUTILUS. See **ARGONAUT**.

PAPER-HANGINGS, a term applied (somewhat incorrectly) to the stained paper pasted against the walls of apartments, &c. The word hangings was originally and properly applied to the woven or embroidered tapestry with which the walls of apartments were covered. From the time necessary for their production, these were too costly for any classes but the wealthy. More than 200 years ago, however, a mode was devised of printing or painting a pattern on sheets of paper and pasting them against the walls of a room. These are paper hangings, or wall-papers, and they have greatly contributed to the comfort and cleanliness of domestic apartments.

Previous to the invention of the paper machine [see **PAPER**] sheets of paper of the size called *Elephant* were pasted together to make lengths of 12 yards, and upon these the pattern was imprinted, but now the paper is made in webs of any length that may be required. There are several methods known for producing the required device, but most of the wall-paper now manufactured is either hand, block, or machine printed. In the preparation of wall-paper by hand, wooden blocks are sometimes carved so as to represent in relief the outlines of the figures; an impression is taken from these blocks, and the device is completed by painting with a pencil. By another method the paper is first covered with a uniform ground colour, and the required pattern is produced by means of stencilling, but both of these modes are too slow and costly for ordinary use. In the hand process most generally adopted, large blocks of pear or poplar wood are carved for each of the colours to be employed, and a uniform ground having been laid down, an impression from all the blocks in succession fills up the design upon the paper. Each block is furnished with small pins at the corners, and with what are termed "guide lines," by the aid of which the successive impressions are made to correspond properly. As many as seven or eight colours are sometimes employed in one pattern, and, generally speaking, there must be, as in ordinary printing, as many blocks as there are colours. The vehicle employed to give adhesiveness and body to the colours is a solution of gelatine or glue, sufficiently strong to gelatinize on cooling. The satiny lustre observable in some paper-hangings is produced by dusting finely powdered French chalk over the surface, and rubbing it strongly with a brush or burnisher. The ground for this purpose is prepared with plaster. Flock or velvet papers are produced by covering the surface of the pattern with a mordant formed with boiled oil thickened with white lead or ochre, and then sprinkling powdered and dyed woollen flocks upon it.

Gold paper-hangings take their name from a similar application of gold or Dutch metal in leaf or powder.

In machine printing the webs of paper are passed through a machine resembling that used in calico printing, and provided with a separate printing cylinder for each colour required. The paper thus receives the whole pattern in one printing, and the whole process only requires a second or two for each length of 12 yards. A two-coloured pattern may be worked off at the rate of 500 pieces in an hour, and 100 pieces of a twenty-coloured pattern may be thrown off at the same time.

PAPILAGONIA, in classical geography, was the name of a large district lying along the middle of the southern shores of the Euxine (Black Sea), that is between Bithynia on the west and Pontus on the east. It was conquered and brought into civilization by Cæres (Kroisos), the famous king of Lydia, and from him it passed to Persia upon his overthrow. Later it fell to Mithradates, the great monarch of Pontus; and, upon his fall, to his conquerors, the Romans, who made it part of the province of Galatia.

PAPHOS, a town, or rather two neighbouring towns (Old Paphos and New Paphos), on the west coast of Cyprus in classical times. Old Paphos (the modern Konuklia representing nearly its site) lay a mile inland from the promontory of Zepheion, and New Paphos, in the plain (the present Bafra), about 7 miles further from the coast. The former is the most celebrated, from its great cult of the goddess Aphroditê (Lat. *Venus*), who, according to the myth, was born of the foam of the sea, and was wafted ashore at Paphos. Hence she is frequently called the Paphian or the Cyprian goddess (*Paphia Kapris*). But the town is evidently Phœnician in origin, and the worship of the goddess is that of the Phœnician Astarteth with variations. The annual procession in honour of the goddess from New Paphos to Old Paphos was one of the great ceremonials of antiquity. On the destruction by earthquake of Old Paphos the Emperor Augustus caused it to be rebuilt, from reverence to the goddess; but in honour to himself it was then named *Augusta*.

The poets (Ovid, for example) declare that Paphos was founded and named after himself by Paphos, the son born to Pygmalion, the sculptor, by the statue "Galatea," which he fell in love with after he had made, and which at his earnest prayer was endowed with life by the goddess Aphroditê.

PAPIAS, Bishop of Hierapolis, in Phrygia, an ecclesiastical writer of the second century, was a contemporary and companion of Polycarp. Irenæus speaks of him as "a hearer of John, and an ancient man"—words sufficiently ambiguous to give rise to diversity of opinion. It has been disputed whether John the apostle or John the presbyter is meant. The latter is the most probable. Eusebius speaks highly of Papias in one place, in another very disparagingly.

In the "Paschal Chronicle" it is said that Papias suffered martyrdom at Pergamus in 163. The Roman Catholic Church commemorates him as a saint on the 22nd of February. He appears to have been a millenarian. A work in five books, entitled "Explanations of the Lord's Discourses," proceeded from his pen, and fragments of it have been published. The entire work is lost, but it seems to have contained traditions, anecdotes, and stories respecting Christ, the apostles, and their teachings, which, though many of them were doubtless fabulous, would have been of great value in these days.

PAPIER-MÂCHÉ, the French term for a preparation of moistened paper, of which many articles are manufactured in England, France, and Germany. Two modes are adopted of making articles of this kind—1, by gluing or pasting different thicknesses of paper together; 2, by mixing the

substance of the paper into a pulp and pressing it into moulds. The first mode is adopted principally for those articles, such as trays, &c., in which a tolerably plain and flat surface is to be produced. Common millboard, such as forms the covers of books, may convey some idea of this sort of manufacture. Sheets of strong paper are glued together, and then so powerfully pressed that the different strata of paper become as one. Slight curvatures may be given to such pasteboard when damp by the use of presses and moulds. It is then varnished and polished in various ways. Some of the articles now made in this manner have their surfaces inlaid with mother of pearl; the shell is fastened down to the surface as a veneer, an immense body of varnish is laid on, and by rubbing the superfluous varnish from the pearl, the whole is brought to one common level, presenting a brilliant, if not always tasteful, effect. *Papier-mâché*, properly so called, however, is that which is pressed into moulds in the state of a pulp. This pulp is either paper-makers' pulp, or is more generally made of cuttings of coarse paper boiled in water, and beaten in a mortar till they assume the consistence of a paste, which is boiled in a solution of gum-arabic or of size, to give it tenacity. The moulds are carved in the usual way, and the pulp poured into them, a counter-mould being employed to make the cast nothing more than a crust or shell, as in plaster casts.

The term *papier-mâché* is in trade held to apply rather to the articles made of the pulp than to the pulp itself; and a vast manufacture has sprung up during the present century, particularly in Birmingham, in which a great variety of articles of use and ornament are made of this material. Decorations for ceilings and walls, panels for the saloons of steamboats, and numberless light and useful articles—some of exceedingly handsome appearance—are made of *papier-mâché*.

A combination of stucco and *papier-mâché*, known by the name of *carton pierre*, is used for casts of statues, busts, friezes, pilasters, foliage, and architectural ornamentation. It is a mixture of paper pulp, whiting, and glue; and it is pressed into moulds and hardened by drying.

PAPILIONACEÆ, a fanciful name given to the principal division of leguminous plants, from an imaginary resemblance between their flowers and a papilio or butterfly. The garden pea affords an example of the structure of the flowers, in which the back petal is named the *vexillum* or standard, the two external of the side petals *alæ* or wings, and the two interior petals, which adhere by one edge, the *carina* or keel. See LEGUMINOSÆ.

PAPILIONIDÆ. See BUTTERFLIES.

PAPILLA (Lat., a small nipple or teat), a name applied in physiology to any nipple-like vascular process of the skin. The chief varieties in man are the papillæ of the TONGUE, its organs of touch and taste; the papillæ of the gums, which generate the TEETH; the papillæ of the KIDNEYS, which discharge the secretion into the central chamber of that organ, and the general papillæ of the skin, the means of its sensibility. There are also the sunken papillæ whence the HAIR grows, and akin to these, the similar papillæ which in birds produce FEATHERS. All these various papillary structures are described under the articles dealing with the organs or growths named.

PAPIN, DENIS, a French physicist, and one of the inventors of the steam engine, was born at Blois, in 1647. He came of a Protestant family, and in 1661 or 1662 he entered upon the study of medicine at the Protestant University of Angers, where in 1669 he took his medical degree. That his means were then narrow—as they continued to be throughout his life—is proved by the fact that he bound himself to pay the examiners' fees out of the first returns he should realize in the practice of his profession. It is not certain, however, that he made any

effort to follow the calling for which he had been educated, his chief interest being in the direction of physics and mechanics. Some time prior to 1674 he removed to Paris, where he assisted Huyghens in his experiments with the air-pump, the results of which were published that year under the title of "Nouvelles Expériences du Vivide." Soon after this event he crossed to London, where he was hospitably received by Boyle, with whom he laboured for three years, being engaged chiefly in experiments with regard to the weight of the atmosphere. During this period he introduced some important improvements into the air-pump, and in 1680 he was admitted, on the nomination of Boyle, to an honorary membership of the Royal Society. The following year he communicated to the society an account of his celebrated "steam digester," an apparatus designed for the softening of bones and the extraction of their gelatin. [See DICESTER.] In 1687 he was appointed professor of mathematics at Marburg, remaining here until 1696, when he removed to Cassel, where he remained until 1707. All this time he kept the idea of producing a motive power by the aid of fire before him, and made numerous experiments with steam engines of various design. According to one account he caused a steamboat to be constructed from his designs, in which he set out in 1707 with his family from Cassel for London. All went well until he reached the mouth of the Weser, where he had to encounter the opposition of a guild of watermen, who enjoyed a monopoly of the navigation of the river, and who would not allow him to proceed. He was promised protection by the local authorities, but the boatmen rose in riot, compelled him to disembark, and then destroyed his vessel. On his subsequent arrival in London he found himself almost without resources, and after appealing in vain to the Royal Society for aid he sank into obscurity, so that the time and circumstances of his death are unknown. In connection with the steam engine he was unquestionably the inventor of the safety-valve and of the piston, and though his inventions never attained any practical success, they formed essential elements in the inventions of his successors. In 1880 a statue erected in his honour was unveiled at Blois, and a biography, with much of his correspondence with Leibnitz and Huyghens, was published by Dr. Ernst Gerland at Berlin in 1881.

PAPIN'IAN, an illustrious Roman jurist, was *ademptus fisci* under the reign of Marcus, and under Severus *libellorum magister* and afterwards *praefectus praetorio*. It is probable that he accompanied the Emperor Severus to Britain, and before his death the emperor commended his two sons to his charge. He endeavoured in vain to keep the peace between the brothers, and ultimately he was dismissed from his office and afterwards murdered by the order of Caracalla. It is stated that he was beheaded in the emperor's presence, and that his son, who held the office of quaestor, lost his life about the same time, both events taking place in the general slaughter which followed the fratricide of 212 A.D.

The works of Papinian exist only in excerpts. They consisted of "Quaestiones," in thirty-seven books; "Responsa," in nineteen; "Definitiones," in two books; and "De Adulteriis," in two books. No less than 595 excerpts from these exist in the *DIGEST*. Paulus, Ulpian, and Marcion cite and comment upon him, and his fame as a jurist was very high at Rome. Nor was the place which he occupied in the public estimation undeserved, for his knowledge, acuteness, ability, and integrity made him a lawyer of the highest order.

PAP'POS, ALEXANDRI'NOS, an eminent mathematician of Alexandria, who flourished about the end of the fourth century of our era. In the very brief accounts we have of him he is mentioned as the author of several treatises, all of which, except his "Mathematical Collec-

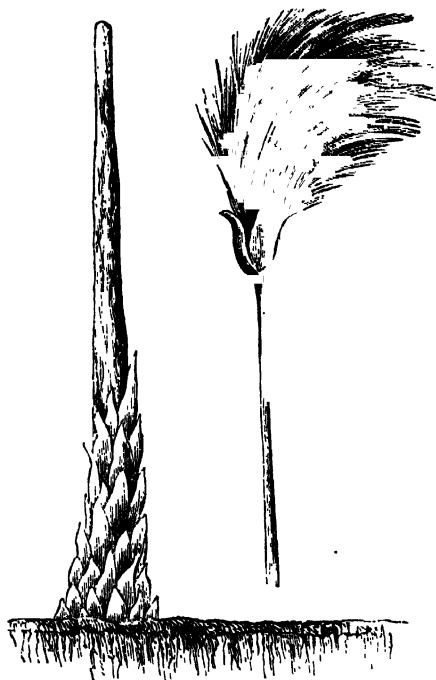
tions" (probably, by good fortune, the most valuable of his writings), appear to have perished. Independently of its geometrical value, the work of Pappos abounds in matters of importance to the history of the science.

PAP'PUS is a peculiar form assumed by the calyx of certain flowers, chiefly of the order *COMPOSITAE*. The down of the dandelion is a familiar instance of pappus in a state of beautiful division, resembling fine feathers.

PA'PUA. See NEW GUINEA.

PAPY'RIN. This substance, known also as vegetable parchment or parchment paper, is a large article of manufacture, and is much used as a substitute for bladder in covering jams and jellies and for packing purposes. It is made by dipping ordinary white unsized paper in oil of vitriol partly diluted with water; the surface is partially dissolved or gelatinized, and when washed and dried it becomes exceedingly tough and practically waterproof.

PAPY'RUS (*Cyperus papyrus*), the paper reed, is an aquatic plant, a native of Nubia and Abyssinia, the Niger, and Syria. It was largely cultivated by the ancient Egyptians for the manufacture of paper, but is not now found in Lower Egypt. The creeping underground stems (rhizomes) are about as thick as a man's wrist, sending down numerous roots into the soft mud, and throwing up here and there stems 10 or 12 feet high, with a tuft at the top of sedge-like flowers and long bracts. Macgregor,



Paper Reed (*Cyperus papyrus*).

in "Rob Roy on the Jordan," writes:—"At this place (Waters of Meron) the papyrus is of the richest green, and upright as two walls on either hand, and so close in its forest of stems, and dark, recurving, hair-like tops above, that no bird can fly into it. . . . I found that the margin of the lake about me was waving up and down, and the papyrus stems were rubbing against each other as they nodded out and in. It was plain that the whole jungle of

papyrus was floating upon the water, and so the waters, raised by the breeze, were rocking the green curtain to and fro." It was from the pithy stem that the slices were taken which were prepared as writing material.

PAPYRUS, the name given to the written scrolls which have been found in Egypt, Italy, and elsewhere. It was formerly supposed that the parts of the plants used for writing were certain thin concentric layers growing between the rind and a central stalk, but it is now proved that the plant, like other reeds, contains only a cellular pith within the rind. In the preparation of writing material the stem of the plant was cut into thin longitudinal strips, which were laid upon a board side by side to the required width, and covered by a second layer of shorter strips laid at right angles. The whole was then saturated with water or paste, and the strips pressed together so as to form a continuous sheet, which was then carefully dried in the sun, and smoothed and polished by rubbing with a piece of ivory or a smooth shell. To form a roll the sheets were joined together with paste, and thus rolls (volumes) of any size could be prepared. When newly made the papyrus was white or brownish-white in colour, and the sheets were pliant and elastic. For writing upon them a reed pen was used, the ink, black or red, being prepared from animal carbon. The papyrus was used in Egypt from a very remote period for books and written documents, and from Egypt it spread to most of the civilized nations of the world. Its early use among the Greeks is proved by a reference of Herodotus, and after the time of Alexander the Great papyrus became an important article of commerce between Egypt and Greece. The Romans appear to have imported both the prepared papyrus and the raw material for home manufacture, while they are said by some historians to have cultivated the reed itself in several places in Italy. The intimate relation which this material had to literature is seen in the fact that from its name is derived the word paper; its Egyptian name, *bublos*, is preserved in the Greek *biblion*, a book; and from *liber*, the part of the plant employed, is derived the Latin *liber*, a book. The use of papyrus was retained in Europe until the twelfth century; but long before that time it had been largely superseded by parchment, and during the twelfth century the manufacture of papyrus entirely ceased. In modern times papyrus is made in Sicily in small quantities as a curiosity, but the manufacture is of no commercial importance.

Of the works written upon this material the earliest, as might be expected, are those found in Egypt—the most ancient known (the Ptolemy papyrus, preserved at Paris) dating from a period anterior to 2000 B.C. The Egyptian rolls have been found chiefly in the mummy cases, either placed in the hands or upon the bodies of the mummies, or else swathed round them among the bandages by which they are enveloped. Others have been found inside hollow wooden figures of the deities worshipped by the Egyptians, which have been placed in the tombs, or in jars or boxes found in similar places. They are divided into *hieroglyphic*, *hieratic*, or *demotic* papyri, according to the written character employed, and they comprise works on religious ritual, prayers, magical formulas, religious doctrines, and theological and eschatological speculations; documents relating to the political, social, and literary history of Egypt; poems, works of fiction, treatises on medicine and botany; and a large number of contracts and legal documents relating to sales of property, &c. The papyri as found are generally brown in colour, and exceedingly brittle and fragile; but the writing is generally legible, and a very large number of translations from these ancient documents have been made and published by modern scholars.

Some Greek papyri, of great value and importance, have also been found in Egypt; and among the relics of anti-

quity unearthed at Herculaneum were some charred rolls of papyrus, marked with writing in Latin and Greek, which, by a very laborious process, was rendered legible and copied. They were found to represent a collection of the works of philosophers of the Epicurean school, and were of comparatively little interest to scholars; but it is still hoped that future excavations may result in the recovery of some of the lost works of antiquity, of which the names only have up to the present come down to us. Of the Greek papyri the characters are mostly uncial, or in capital letters, and for the most part written in columns on one side only. An illustration of this mode of writing may be given by arranging the beginning of this article thus:—

PAPYRUSTH	LSWIIICHHH	ISEWHERE
VEBENEGVIE	VEBENFOU	ITWASFOR
NTOTHEWRI	NDINEGYPT	MERIASUP
TTENSCROL	ITALYANDE	POSEDTHA

There were no divisions of words and no punctuation in papyri scrolls. In the later periods during which papyrus was used, it was cut up into square pages and bound like modern books.

PAR (Lat. *par*, equal), a term used in monetary transactions. When an obligation of any kind sells for its nominal value, as when £100 consols fetch just £100, it is said to be "at par." If the obligation fetches less than its nominal value it is "at a discount," or "below par;" if more, it is "at a premium," or "above par," by such and such a fraction.

PAR OF EXCHANGE. Conversion of money from one coinage to another is effected by estimating the one in terms of the other.

The *mint par of exchange* is the comparison between the real amounts of gold or silver in the respective coins. Thus, as the English sovereign contains 113.002 grains of gold (disregarding the alloy) and the German 20 mark piece contains only 110.592, the mint par with Germany, on the basis of the sovereign, is 20s. to nearly 19s. 7d., or as it is expressed in the "course of exchange," £1 = 20.13 marks, a result obtained by the following proportion—110.592 : 113.002 :: 20 shillings : 20.43 marks.

The following are some of the chief mint pars of exchange:

£1 =	25.2213 French francs,	Italian lire,	Greek drachmai,	Spanish pesetas,	Finnish marks,	Romanian leys,	and Servian dinars.
£1 =	5.044 Colombian or Chilean pesos,	Peruvian sols,	Venezuelan venezolanos,	Uruguayan piastres.			
£1 =	18.16 Scandinavian kroner.						
£1 =	20.43 German marks.						
£1 =	10.215 Austrian florins.						
£1 =	12.107 Dutch guilders.						
£1 =	110.70 Turkish piastres (about).						
£1 =	97.50 Egyptian piastres (about).						
£1 =	4.84 United States dollars.						

This last should be 4.865, but it is put at 4.84 by tariff to allow for "mint remedies" and a moderate amount of wear and tear.

Another class of mint pars is where the English money is reckoned on the basis of the foreign. The following are the chief:—

Spanish piastre	=	47.5785 pence English,	say 3s. 11½d.
Portuguese milreis	=	53.284 " "	(4s. 5¼d.)
Russian rouble	=	38 " "	(8s. 2d.)
Indian rupee	=	22.6 " "	(1s. 10½d.)
Japanese yen	=	49.17 " "	(4s. 1¾d.)
Mexican dollar	=	51.5 " "	(4s. 3½d.)
Brazilian milres	=	26.93 " "	(2s. 8d.)

The *arbitrated par of exchange* is that which results from a consideration of (1) the balance of indebtedness and

the demand for bills on one side or the other; (2) the relative values of gold and silver when the standard differs; (3) the loss of interest by waiting till the payment of the bill, &c.; (4) the business risk attached to discounting bills, since a certain variable proportion of them are sure to be delayed or dishonoured.

PARÁ, or *Santa Maria de Belém do Gram Para*, a town in Brazil, situated on the right bank of the Rio do Para, and about 70 miles from its mouth; this river is about 7 miles wide opposite the town. Para is well laid out and has several fine buildings, the chief of which are—the cathedral, the bishop's residence and college, an hospital, the governor's residence, and the custom-house. There is a fine botanic garden. The chief exports are, Brazilian produce and drugs; cacao, coffee, sugar, and rice; hides and horses; and it is the mart through which passes the whole of the commerce of the Amazon and its tributaries. The imports are principally cotton goods, wheat and flour, cutlery and hardware, wool, and wine. Vessels of deep draught can lie near the city. In consequence of the disturbed state of the country and the massacres committed by the Indians in 1834-35, the number of inhabitants decreased from 21,000 to 6000, and grass grew in many of the streets. Since 1818, however, the town has entered upon a new career of prosperity, and the population is now 25,000. There is a line of railway to Rio de Janeiro.

PARÁ, a copper coin in great use in Egypt and Turkey. It is the fortieth part of the Egyptian piastre: worth therefore, on the average, about a sixteenth part of a penny, say a quarter of a farthing in our money (rather less than this in Turkey). Small as it is, it is divided into three *aspers* or *minas*. The para of Servia is the hundredth of the Servian *dukar*, i.e. the exact equivalent of the French centime, or a little less than the tenth of a penny of our money.

PARABAN'IC ACID, an acid obtained from alloxan by oxidation. It crystallizes in colourless prisms, which are soluble in water. The formula is $C_8H_4N_2O_8$. When boiled with ammonia it is converted into oxaluric acid ($C_3H_4N_2O_4$), by taking up the elements of water.

PARABLE (Gr. *parabole*, a comparison or similitude) is defined by Lowth as "a continued narrative of a fictitious event, applied by way of simile to the illustration of some important truth." It is a species of fable, and differs from the apologue by narrating events which, though fictitious, are not impossible to have happened. [See FABLE.] In the Old Testament the Hebrew *mashal*, which corresponds to the Greek *parabole*, has a large range of application, and is applied to proverbs, enigmatic maxims, obscure prophetic utterances, and short fictitious narratives, and in the New Testament the Greek word is used with a like latitude. The parable has ever been a favourite method of teaching among Eastern nations, and though its use is known everywhere, it is to the East we must look for its true home. There are several examples of the use of the parable in the Old Testament, and it would be hard to find in the whole extent of human literature a better illustration of its power than that recorded in 2 Sam. xii. 1-7. The rabbis of a later period frequently employed the parable in their teachings, and there are numerous instances of its use by Hillel, Shammai, and others recorded in the Gemara and Midrash. In the New Testament parables form a marked feature in the teaching of Jesus. It appears from Matt. xiii. 10, that this mode of teaching was not adopted by Jesus at the outset of his public ministry, but that he introduced it on account of the reception his more direct appeals had received from the multitude. It must be admitted, however, that some obscurity still rests over the passages, Matt. xiii. 11-15, and Mark iv. 10-12, in which certain reasons are given for the use of parables by the Master to his disciples.

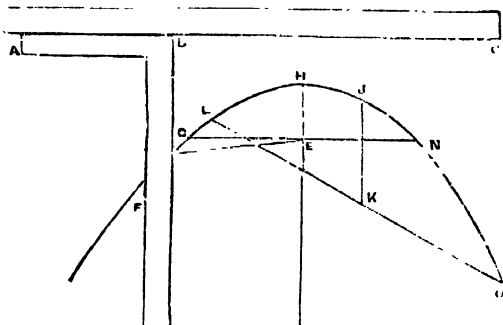
The parables of Jesus have been the subject of much comment and exposition from the time of the fathers up to the present day, and there has been much divergence of opinion as to their scope and interpretation. One of the best commentaries from the orthodox point of view in the English language is the "Notes on the Parables of Our Lord," by Dr. Trench (9th edition, London, 1861).

PARAB'OLA, one of the cone sections. It is the curve described by a moving point which is always at the same distance from a fixed line (its *directrix*) that it is from a fixed point (its *focus*).

In applied mathematics the parabola was formerly of great importance, both as being the curve in which a comet was supposed to move, and as that in which a cannon-ball or other projectile would move were it not for the resistance of the air. It is still sometimes used as the approximation to the elongated ellipse in which a comet moves.

The mechanical construction of the parabola is as follows:—

In the annexed figure, let ABC be a straight-edged ruler, and ABD a common joiner's square; and let a thread of a length equal to BD be fixed by one extremity to the end of the square D , and the other to any point, E , between



the two rulers. If now the side AB of the square be moved along the edge of the ruler ABC , and a pencil is applied to the edge BD , so as always to keep the thread stretched, at the same time that it allows it to slip round its point F , the pencil will describe a curve, $F L H J$, which is a parabola.

The point, E , about which the thread moves, is called the *focus*, and the line ABC the *directrix*.

A line, EM , drawn through the focus E , and perpendicular to the directrix, is called the axis of the figure.

The point H , in which the axis cuts the curve, is called the *vertex* of the figure.

A line, EN , passing through the focus E at right angles to the axis and terminated by the curve, is the *parameter*.

Any line which can be drawn within the limits of the curve, parallel to the axis, as JK , is called a *diameter*.

If a tangent were drawn to JK at J , the extremity of the diameter, a line, EO , drawn parallel to it, is called a *double ordinate*. The double ordinate through the focus (GEN) is called the *latus rectum*.

That part of any diameter which is contained within any part of the curve itself and its ordinate, as JK , is termed an *abscissa*.

The equation to the parabola is $y^2 = 4a(x - a)$, when the directrix is taken as the axis of y , and the axis of the curve as the axis of x , and it is evident that the vertex H in the above figure lies midway between E and ABC . Here a is the distance EH , and the distance x is measured along HE from the line ABC . If, however, we measure x from the point H itself, which is expressed in the language of co-

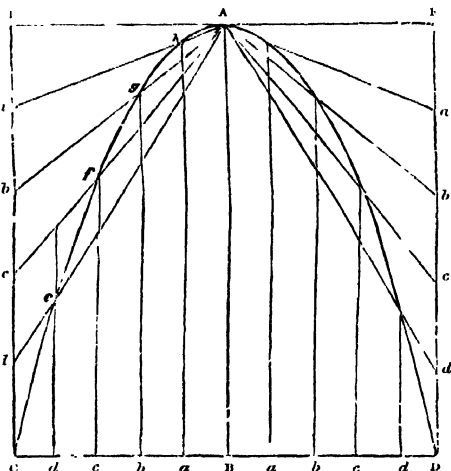
ordinate geometry by the phrase "putting the origin at n ," and remember that we shall always be the distance nx short in our value of x , which in practical working will not alter the curve, then we can simplify the equation to $y^2 = 4ax$, which is the usual formula.

Or let AB be the given axis of a parabola, and CD a double ordinate, as in the figure below. It is required to delineate the curve, by a process which shall determine a number of points in its course.

1. Through A draw EF parallel to the double ordinate CD . Through C and D draw the perpendiculars CE and DF parallel to AB .

2. Divide BC and BD into any number of equal parts, as five. Likewise divide CE and DF in a similar manner.

3. Through the points a, b, c, d in CD , on each side of the point n , draw the perpendiculars de, cf, bg, ah , &c., and through the points a, b, c, d in CE and DF , draw lines to the upper extremity A of the transverse axis AB , respectively cutting the perpendiculars drawn from the



line CD , in the points e, f, g, h ; then will the points of intersection to the right and left of the transverse axis be situated in the curve of the required parabola, which will be completed by tracing a line steadily through them.

The parabola is a curve of frequent uses. The mirrors of reflecting telescopes have, for example, to be accurately parabolic to overcome spherical aberration. If a lens could be truly ground to a parabola, a like result would ensue, and would be eminently desirable; but the difficulty of the work has caused other means of correction to be adopted. See LENS.

PARABOLOID. The simplest form of this surface is the paraboloid of revolution, made by the revolution of a parabola about its axis.

PARACEL'SUS, the self-assumed name of Theophrastus Bombast von Hohenheim, a celebrated physician, who was born near Einsiedeln, in the canton Schwyz, about 1493. His father, Wilhelm Bombast Hohenheim, was a struggling physician, and his mother had previous to her marriage been the superintendent of the hospital at Einsiedeln. He received from his father the rudiments of education and some knowledge of medicine, after which he appears to have become one of the poor scholars of that period, and to have roamed about from college to college, and from convent to convent in search of knowledge, making everywhere the best use of his time and opportunities. Among his masters Trithemius, bishop of Sponheim and

Würzburg, an alchemist of some repute, holds the first place. He declares in writings that he studied at the chief universities of Italy, France, and Germany, and graduated as a doctor of medicine, but when and where this took place is not clearly known. He was next employed at the mines in the Tyrol, owned by the wealthy family of the Fuggers, and after a period of service there he commenced a series of wanderings throughout Europe, animated by the laudable ambition of adding to his knowledge. In his journeys he not only visited the universities and conversed with the learned, but he carefully inspected mines, smelting works, and manufactures, made the acquaintance of gypsies, herbalists, &c., and in this way acquired an immense store of facts not generally known by the physicians of that period. By his shrewdness and sagacity he was enabled to effect numerous striking cures, and in 1526 or 1527 he was appointed to the double chair of medicine and chemistry at the University of Basel, being thus the earliest public teacher of the latter science on record. He had long ere this formed the opinion that the medical science of his time needed a thorough reform, and in his lectures he expressed this conviction in a manner which startled and amazed his hearers. He began by publicly burning the works of Galen, delivered his lectures in German instead of Latin, and instead of commenting on the works of the early writers on medicine, he expounded his own theories and methods, giving illustrations from his personal experience. Further, he criticised in terms of great severity the current medicine of his time, and exposed with an unsparing hand the ignorance and selfishness of its practitioners. For a short period his teachings were received with an enthusiasm on the part of the students which carried all before it, but of necessity Paracelsus aroused much bitter hostility on the part of the physicians and apothecaries of the town, and ultimately, after a fierce conflict with the authorities, who had unjustly decided a case against him, he had to make a hurried flight about 1528. He went first to Esslingen, but after a brief stay was compelled by absolute want to recommence his wandering life. From the dates of his various writings it appears that in 1528 he was at Colmar; in 1531 in St. Gallen; in 1536 at Augsburg; afterwards at Kromar in Moravia, at Vienna, and in 1538 at Villach, where appeared his work "De Natua Rerum." In 1541 he was invited by Archbishop Ernst to settle at Salzburg, and he died there the same year on the 24th September. He was buried in the churchyard of St. Sebastian, but in 1572 his remains were removed to the porch of the church and a monument of reddish-white marble was erected to his memory.

His character has been very variously estimated. By the obstructives of his age and by many hasty judges since, he has been pronounced an ignorant quack, but such a judgment is quite out of harmony with the circumstances of his career. In spite of his admitted tendency to paradox and exaggeration, in spite of his fantastic dreams, he was a man of great intellect and force of character, and one who did the world good service. He had a lofty ideal of the medical profession, and in opposition to the commentating spirit of the schoolmen, he pointed out that truth must be sought in nature rather than in books. It is clear that he introduced some new compounds of great value to the medical profession, and he rendered good service to the study of chemistry by showing that it formed an essential part of medical education. Had his self-control and prudence been equal to his intellect he would have been one of the great spirits of the world, but unhappily his weaknesses and faults were as great as his abilities, and hence his career was a failure, and the school he founded soon degenerated into open quackery. His works have been many times reprinted, and many productions have been published under his name, which are un-

doubtedly, spurious. The first collected edition and the best, though it contains many spurious pieces, was that issued in German by Johann Musser, in eleven vols. 4to, at Basel, in 1589-91.

PAR'ACHUTE. See BALLOONS.

PAR'ACLETE (Gr. *paraklētos*, an intercessor), a name applied to the Holy Spirit as the advocate and comforter of man. It was believed by many of the early Christians that the Paraclete, whose mission was foretold by Christ, would appear on the earth in a bodily shape, and perfect the new dispensation.

PAR'ACLETE (Gr. *paraklētos*, one who is called to our aid, a comforter) was the name given to the famous semi-monastic institution founded near Troyes by Abélard in 1122. He made it a religious community of philosophic thinkers, bound, however, by no religious vows and governed by no rigid monastic rules; where all doctrines and mysteries were habitually and freely discussed, in a sort of mediæval religious imitation of the ancient schools of philosophy in Greece. Its cells rapidly proved far too small for the crowding students. Continual and unrelenting persecution from Norbert and from St. Bernard, who feared lest this free disputation should engender heresy, at length broke down the institution, and Abélard retired to the monastery of St. Gildas de Rhuys on the coasts of Morbihan, Brittany. The Paraclete was deserted as soon as his brilliant leader was gone; and seeing that this was the case Héloïse, the former mistress of Abélard, now prioress of Argenteuil, was glad to occupy it with her nuns, for she had been chased from her convent by the monks of St. Denis. The necessary correspondence with the man she had so wildly loved brought about those famous letters of reminiscence of their bygone passion which have immortalized these lovers. Héloïse's share in them is that which impresses one the most, and her letters were all written from the Paraclete.

PARACYAN'OGEN. This is a black substance obtained when cyanide of mercury is heated in making cyanogen. It is left behind in the flask with the mercury. It is isomeric with cyanogen, and is insoluble in water and alcohol. It is also found sometimes in prussic acid after long keeping.

PARADISE, a word of Aryan origin, which occurs in Sanskrit under the form of *paradīsa*, and which passed through the Persian into the Greek language as *paradeisos*, into the Hebrew as *pardēs*, and into the Arabic as *firdaus*. It signified originally a kind of park or pleasure ground, inclosed with walls, well watered and planted, and stocked with animals for the chase. In the Old Testament the word occurs in Cant. iv. 13; Eccles. ii. 5; Neh. ii. 8; and it was adopted by the Septuagint translators for the garden of Eden. The term was interpreted symbolically by the Jewish philosophical school of Alexandria, and Philo resolves the whole story of paradise into an allegory; but the rabbis of Palestine, on the other hand, taught that there still existed in a far distant region of the earth, and beyond the reach of man, the old Eden that had been lost by the fall. It was believed to be the abode of the spirits of the blest, not of all the righteous, but of the holiest and best among them. At the time of Jesus, the popular belief of the Jews was that paradise was a place of rest, peace, and joy, and their prayers for the dying or the dead were petitions that their souls might be admitted there. In the New Testament the term is only once used by Jesus, viz in his answer to the appeal of the dying malefactor (Luke xxiii. 43); once by the apostle Paul in describing an ecstatic vision (2 Cor. xii. 4); and once again in the Book of the Revelation (chap. ii. 7). In the first instance the reference is simply to the spirits' home of rest, and in the other passages the term is necessarily invested with a mystical and figurative meaning. In patristic times the conception of paradise as the home of the soul received

considerable development, and the notion of an earthly paradise gradually gave way before the more ideal conception of a heavenly paradise. A similar evolution may be traced in the history of Jewish thought, and by some of the rabbis it was asserted that the heavenly paradise, reserved as the home of the chosen people, was sixty times as large as the whole lower earth. At the present day the term is often used to signify an abode for the spirits of the righteous during the interval between death and the final judgment and consummation of all things; but modern theologians are content to use the word as merely a convenient symbol for ineffable things, and prudently refrain from attempting to define that which must ever remain above and beyond human thought.

PARADISE, BIRD OF. See BIRD OF PARADISE.

PAR'ADOX (Gr. *para*, beside or beyond, and *dōxa*, in opinion), a proposition or statement that is opposed to be commonly received opinion or to an established fact. It was originally applied by the Stoic philosophers to such of their maxims as were opposed to the prejudices of the vulgar, and used in this sense it was implied that the proposition, though opposed to current opinion, was yet true in itself. As a matter of experience, there have been many bold and happy statements made under the inspiration of genius, which, though at first seemingly paradoxical, have in course of time come to be accepted as self-evident truths. Earnest thinkers also, seeking to impress their discoveries upon the minds of men, have often used a paradoxical form of utterance with much success. The apparent contradiction sets men thinking, and meditation reveals the truth concealed. In modern parlance the term is applied to such figures of poetry or rhetoric as couple seemingly conflicting ideas, such as Emerson's

"The silent organ loudest chants
The master's requiem,"

or Tennyson's more familiar lines,

"His honour rooted in dishonour stood,
And faith unfaithful kept him falsely true."

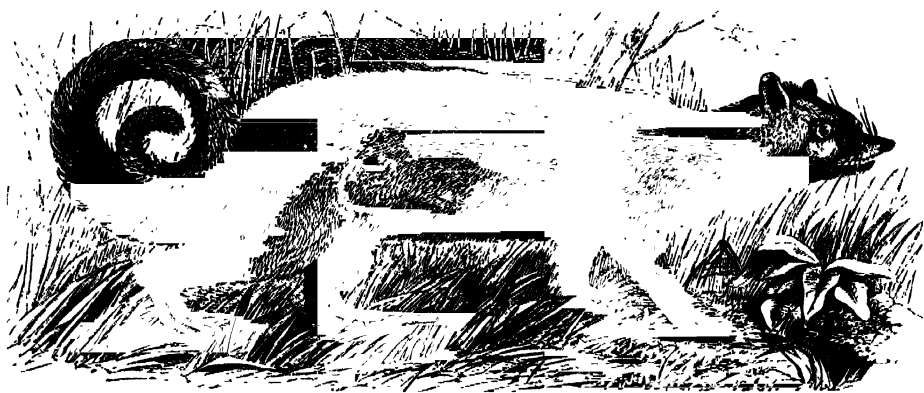
PAR'ADOX, THE HYDROSTATIC, is a particular case of the pressure of liquids, when a vessel is larger at the base than in the upper part. Let a rectangular vessel have a square base, one side of which is shown by the figure $ABCD$, out of which rises the pipe A . Then, by the laws of fluid pressures, the pressure upon the base AB , when the vessel is full, is the same as it would be were the whole vessel a cube with AB for its side. And yet the difference in weight between such a cube and the figure in the illustration (which is only equal to the cube at the base) would be considerable, as tested by a weighing machine. The paradox is that equal pressures should be given by unequal weights.

The explanation lies in the fact that the upward pressure of the fluid upon the surfaces whose sections are DE , FC , is exactly equal to the downward pressure of the column of water which in the cubical vessel would stand upon the position occupied by those surfaces. The weight of any vessel full of fluid, whatever its shape, is always exactly the combined weights of the vessel and of the fluid it contains.

PARADOX'URUS is a genus of carnivorous mammals belonging to the Civet family (*Viverridæ*). The Common Paradoxure (*Paradoxurus musang*) or Tree-cat, as it is improperly called, is abundant in India and Ceylon, Burmah, and the Malay Peninsula. It lives in trees, often taking up its quarters in the thatched roofs of native houses. It is nocturnal in its habits, and feeds on rats, lizards, poultry, small birds, eggs, fruits, and insects. In Ceylon, according to Tennent, it is very destructive to the

poultry of the villages. On the Carnatic and Malabar coast it is called the toddy cat, from its alleged liking for the juice of the palm. The body and tail are long, the limbs short, and the feet plantigrade and five-toed; the

muzzle is much pointed. The fur is liable to variation, but has a brownish tint generally, being marked on the back and sides with darker patches of the same colour, somewhat irregularly disposed. The body, from the tip



Paradoxurus musang.

of the snout to the root of the tail, measures from 22 to 25 inches, the tail giving an additional 20 inches.

PARAFFIN and PARAFFIN OIL. The former was first isolated and described by Reichenbach, who, in the course of a series of elaborate experiments with coal, wood, and animal tars, came in 1830 upon a colourless wax-like solid, which from its remarkable resistance to chemical action he named paraffin (Lat. *parum*, little, and *affinitas*, likeness or relation). A few years later he isolated from wood tar a liquid oil chemically similar to paraffin. Both substances, however, were regarded merely as scientific curiosities until 1847, when Mr. James Young, a Glasgow chemist, was induced by Sir Lyon Playfair to lease a small petroleum spring in Derbyshire with a view of turning the material to commercial advantage. As a result of his experiments Young was enabled to prepare two kinds of oil from the crude petroleum, one useful for illuminating purposes, and the other as a lubricant. He also found that the petroleum yielded considerable quantities of paraffin, but it was not at first separated for trade purposes. By the beginning of 1851 the supply of oil from the spring had ceased; but in the meantime Young had been making a series of important experiments in connection with the destructive distillation of coal, and in October, 1850, he obtained letters patent for the "obtaining of paraffin oil, or an oil containing *paraffin*, and paraffin from bituminous coals." The material upon which Young first worked was the once famous, but now practically exhausted Torbane Hill mineral, or Boghead cannel, then selling at about 13s. 6d. a ton. It was found to be peculiarly suited to the purposes of the new industry, yielding as it did from 120 to 130 gallons of crude oil to the ton, and it rapidly advanced in price until just before the supply became exhausted, in 1866, it was worth about 90s. a ton. Long before this, however, it had been discovered that the oil could be obtained from many other sources, and the bituminous shales of the counties of Edinburgh, Linlithgowshire, Lanark, Fife, Ayr, and Renfrew, though they only yielded about 35 gallons a ton, were pressed into the service of the new industry. For several years the chief products from the distillation of shale were the light and heavy, or burning and lubricating oils, but after many difficulties had been overcome solid paraffin

was extracted and at once utilized in the manufacture of candles. The development of the industry in England caused many experiments to be made in other countries in the same direction, and it was soon discovered that petroleum was peculiarly rich in the various paraffin products. This gave rise to the vast petroleum industry of America, and the enormous quantities raised threatened for a time to extinguish the parent manufacture altogether. It did destroy the manufacturing activity of Wales in this direction, but the Scottish manufacturers having better natural advantages were enabled to struggle on until they had so improved their appliances and methods as to render their industry once more remunerative. At the present day, in addition to the oil shales and petroleum, brown coal is utilized in the paraffin manufacture of Germany, and in Austria ozokerite is worked for the same purpose.

It would be impossible within the necessary limits of this article to describe in detail the elaborate processes of the paraffin manufactures, and we can only briefly indicate the more essential operations necessary in the distillation of shale. In this process the raw material is first broken by machinery into pieces not larger than a man's fist, and these are placed in retorts, which are kept at a temperature of about 800° Fahr. In the system of Mr. Henderson, now most generally adopted, the retorts are so arranged that the spent shale is utilized as fuel, and the process of oil extraction proceeds continuously for several days at a time. The vapour produced in the retort is driven off into a system of condensing pipes, in which it is deprived of all its readily condensable parts, after which it is utilized either for illuminating or heating purposes. The product which collects in the condenser chests consists of crude oil, and a weak aqueous solution of ammonia, and volatile ammonia salts. The ammonia water, which was formerly run to waste, is now boiled to cause it to yield its ammonia as a vapour, which is passed into sulphuric acid, thus forming sulphate of ammonia, used mainly for agricultural purposes. Owing to the steadily increasing demand for ammonia the solution obtained in the shale industry is now one of its most valuable products, and several improved processes have been introduced for a more exhaustive extraction of the ammonia from the raw material. The crude oil, which forms a very dark green liquid having a

tarry appearance and very unpleasant smell, is passed on to the refinery, where it is run into large pot-shaped stills capable of holding from 1200 to 1400 gallons, and in these it is distilled until only a dry vascular coke is left. The vapours given off in the process are condensed in a worm, and the product is known as "once run" or green oil. The "once run" oil is now treated alternately with sulphuric acid and caustic soda solutions, each of these treatments yielding a black tar, which sinks to the bottom of the tank, leaving the oil at the top. After this purification it is submitted to fractional distillation, yielding (1) a light naphtha, (2) the chief part of the burning oils, and (3) the heavy oil which contains the solid paraffin. By renewed treatments with acid and alkali and fractional distillations, these products are ultimately resolved into (1) gasoline, a volatile mixture of paraffins which, by means of a current of air, can be converted into a combustible gas; (2) naphtha; (3) burning oil, the paraffin oil of commerce, now so largely used as an illuminating agent; (4) heavy oils, too viscous to be burned in a lamp, but of high value for lubricating purposes; and (5) solid paraffin, a wax-like colourless crystalline substance largely used in the manufacture of candles. The solid paraffin is obtained from the heavy oil by means of filtration, refrigeration, and pressure. The first product, called paraffin scale, is purified by means of the admixture of naphtha, followed by cooling and pressing; and after this process has been repeated several times the naphtha is driven off by means of a current of steam, and the molten paraffin, after filtration through animal charcoal, is allowed to run into moulds. Pure paraffin is both inodorous and tasteless; it possesses none of the staining properties of oil, and when cold it is nearly as hard as beeswax. Its melting point varies to some extent, but is generally stated as being from 110° to 111° Fahr., and its specific gravity ranges from .813 to .940, according to its source and purity. As material for candle-making it possesses a higher illuminating power than stearine, but on account of its greater softness and lower fusing point, it is always mixed with the latter, in order that the necessary hardness and stability may be secured. Among the other purposes to which it has been applied, one of the most useful is in the treatment of the splints used in hiefir-mach making, in which it has taken the place of the sulphur formerly used. Wood treated with melted paraffin ignites easily, and burns without producing any such disagreeable odour as is the case where sulphur is employed. Dissolved in naphtha and mixed with about one twentieth of its weight of vegetable oils, it forms a material that is excellently adapted for rendering cloth, linen, leather, and other fabrics waterproof, while at the same time it increases the tensile strength of the material. It has also been employed as a substitute for wax in modelling fruit, flowers, &c.; for coating the inside of beer barrels; to prevent the decomposition of fresh or preserved fruit; as an "insulator" by electricians, and it has in addition numerous other minor adaptations.

Some idea of the importance of the paraffin industry may be gathered from the fact that the Scottish works alone represent a capital of about £2,000,000, and there is every prospect of this being largely increased in the future. From some inquiries made in 1884 it appeared that the works erected and in course of erection represented a capacity for the distillation of about 1,840,000 tons of shale per annum. This would represent the production of about 55,400,000 gallons of crude oil, from which there would be obtained by distillation about 22,718,000 gallons of burning oil and spirit, 8,900,000 gallons of lubricating oil, 21,700 tons of paraffin scale, and 14,800 tons of sulphate of ammonia.

Peat has been successfully worked for paraffin. The tar from this source is semi-solid, but the purification is difficult, the accompanying oils having a most offensive odour.

Factories on a large scale have been established on the Bog of Allen in Ireland and in Lewis in the Hebrides, but both have been given up.

Paraffin is quite insoluble in water, but very soluble in boiling alcohol, from which it separates completely on cooling, in snow-white needles. Strong acids do not attack it, with the exception of nitric acid, which oxidizes it to succinic acid and other products.

The paraffins or paraffin oils are all of similar constitution, commencing with ethane (C_2H_6), which is gaseous, and rising by regular increments of CH_2 to quinthane ($C_{10}H_{22}$), which is liquid, the boiling-point rising also with each increment of CH_2 , until those containing twenty or more atoms of carbon, which are solids, as $C_{20}H_{42}$, this being about the formula of paraffin wax, which, however, may differ according to its melting-point. See PETROLEUM.

PARAGENESIS (Gr. *pura*, beside; *genesis*, origin), in mineralogy, the mode of association of mineral species. On examining mineral aggregations or igneous rocks, it is found that there is a tendency for particular minerals to occur together, that there are, in fact, certain laws by which the presence of one mineral almost depends upon the presence of another. In an igneous rock containing highly silicated felspars, for example, it is natural to expect associated quartz, for it will rarely happen that no free silica remains behind after the formation of the felspars in the molten mass, and if it does remain, further combination being impossible, it must eventually separate out. Serpentine and olivine rocks are also naturally associated, since the one is probably an alteration-product of the other. In mineral veins galena occurs with quartz, fluor-spar, heavy-spar, zinc-blende, pyrites, &c.; tin-stone occurs with quartz, schorl, chlorite, mispickel, pyrites, zinc-blende, &c.; and numerous other examples might be cited.

PARAGLOBULIN, or *Fibrino-plastic Globulin* or *Fibrino-plastin*, is a white, amorphous, somewhat granular precipitate obtained from the serum of the blood by diluting it with ten times its bulk of water or more, and passing through it a brisk current of carbonic acid; or it may be obtained also by adding dilute acetic acid or a saturation of sodic chloride to dilute serum. It is like fibrin, a proteid, but it differs in many respects from fibrin. It does not occur in the form of fibrils, and though insoluble in distilled water and in alcohol is readily soluble in dilute neutral saline solutions. There are many allied proteids, and these have received the name of *globulins*. The reasoning whereby paraglobulin is believed to be one constituent of Fibrin is shown in the article of that name. The proportion of paraglobulin in blood serum is as much as $\frac{1}{4}$ per cent. on the average, but varying within certain limits in the blood of different animals.

PARAGOGE (Greek *paragōgē*, a leading past, i.e. an alteration) is the grammatical term expressing the alteration of a word in its history as it passes in use from one nation or one age to another. Thus *tyrant* has the final *t* by paragoge, the French word whence it is derived being *tyran* (from the Greek *tyrannos*): other examples are *climb*, *thumb*, *limb* (Old English *clim*, *thum*, *lim*), *sound* (French *son*), *hound* (Latin *canis*). See also the similar variations of PROTHESIS and EPENTHESIS.

PARAGUAY is a republic of South America, situated nearly in the centre of that continent, between 22° and 27° $25'$ S. lat., 57° and 60° $30'$ W. lon. It extends in length from S. to N. about 500 miles, and its average width is about 200 miles. On its western side flows the river Paraguay, on its E. and S. the Parana, and on the N. it is bounded by Brazil. The area is estimated at 91,970 square miles.

The northern part of the country is mountainous. The Sierra Amambay and the Sierra Maracay intersect it and enclose a wild and rugged country, watered by rivers interrupted by cataracts and rapids. The remainder of Para-

gnay, or that part which is situated south of 21° S. lat., is one of the most fertile and pleasant countries of South America. The greater part of the surface is a succession of hills and gently-sloping eminences, and broad open fertile valleys intersected here and there with lakes. The lower grounds and plains are in some tracts savannahs, and afford excellent pasture ground.

The two rivers which inclose Paraguay on three sides differ greatly in their character as navigable streams. The Paraguay is navigable in all its extent within this country, and in 1858 it was opened to ships of every flag. The Parana is much less favourable to navigation, and the great cataract, called Salto de Sette Quedas, near 21° S. lat., forms an insuperable impediment. Some of the smaller rivers which join the Paraguay are navigable for a short distance from their junction with it, and one of them, the Tibiquari, for above 100 miles.

Paraguay enjoys the advantages of the intertropical rains. The principal articles cultivated as food are maize, potatoes, mandioc, yucca-root, and beans. The cultivation of the sugar-cane, tobacco, and cotton is carefully attended to, and since 1864 the latter has been planted on an extensive scale. The principal fruit trees are orange trees and fig trees. The timber trees, gum trees, and dye-woods are numerous and valuable. Most of the animals peculiar to South America are found in this country. Tanning is an important branch of industry, from the abundance of bark and the numerous streams; lime is made on the left bank of the Paraguay, where limestone and fuel are plentiful; manufactures of bricks, tiles, and pottery have also been established; and salt is extracted from salines near Fort Olimpo. The capital of the republic is ASUNCION.

By the constitution proclaimed in 1870 the legislative authority is vested in a Congress of two houses, a Senate and a House of Deputies, and the executive was intrusted to a president, elected for the term of four years, with a non-active vice president at his side. The Senate and Chamber of Deputies are elected directly by the people, the former in the ratio of one representative to 12,000 inhabitants, and the latter one to 6000 inhabitants, though in the case of the sparsely populated divisions a greater ratio is permitted. The senators and deputies receive £100 per annum. At a census taken in 1879 the population was found to be 346,048 (two-thirds being females), exclusive of Indians, semicivilized and partly savage. The semicivilized Indians number 60,000, and the savage 70,000. Among the civilized population are 2000 Italians, 400 Persians, 400 Spaniards, and 40 English. The bulk of the foreigners are, however, Brazilians and Argentines.

Nearly one-half the entire territory was formerly national property, and consisted of pasturage lands and forests. Parts were let at a very moderate rent and for an unlimited period, under the single condition that they should be properly cultivated or turned into pasturage. On other parts of these national lands there were large farms, where thousands of cattle and horses were bred. These supplied the cavalry with horses and the troops with provisions; besides which they also furnished great numbers of oxen for the consumption of the capital. Since 1871, however, the greater part of the national property has been sold in the attempt to restore the shattered fortunes of the country.

The revenue and expenditure are each about £70,000 per annum. The only railway in Paraguay is a short line of 45 English miles, from Asuncion to Paraguari. There was no public debt until 1866, when a foreign loan of £5,000,000 was contracted to carry on the war, besides large internal loans. In 1871 a loan of £2,000,000 was contracted in London, under somewhat discreditable circumstances, according to the revelations of the Foreign Loans Committee of 1875. In the same year the five years' war with Brazil, the Argentine Confederation, and Uruguay was concluded, and the three conquerors imposed

on Paraguay treaties which render the country indebted to the amount of £40,000,000 to Brazil, £7,000,000 to the Argentine Confederation, and £200,000 to Uruguay. The total debt therefore considerably exceeds £50,000,000.

The commerce is small and almost entirely in the hands of the government. The great staple of the country is *yerba maté*, a species of cabbage, the leaves of which are dried and reduced to powder, in which state it is exported, being extensively used in South America as a kind of tea. When the crops of maté are being gathered the government sends its agents to the plantations, who fix the quantity wanted, as well as the price to be paid for it; the remainder is left at the disposal of the proprietor of the land.

Paraguay ("the place of waters") gained its independence from Spanish rule in 1811, and after a short government by two consuls, the supreme power was seized, in 1815, by Dr. Francia, who exercised autocratic sway as dictator till his death in 1840. After this a state of anarchy lasted till 1842, when a national congress elected Francia's two nephews joint consuls of the republic. One of these, Don Carlos Antonio Lopez, was declared sole president by another election in 1844. At the death of Don Carlos in 1862, his son, Don Francisco Solano Lopez, born 1827, succeeded to the supreme power. Under the plea of protecting the independence of Paraguay, President Lopez, in 1865, opposed the government of Brazil, the consequence of which was the entry of a Brazilian army, united with the now allied forces of the Argentine Confederation and Uruguay, into the republic. The struggle lasted five years, during which 200,000 persons perished, the population of the central province being diminished from 450,000 to 20,000 men and 230,000 women and children. The war was brought to a close by the defeat and death of Lopez, who was killed in the battle of Aquidaban, 1st March, 1870. He appears to have been a man of great energy and acute intellect, but unscrupulous, tyrannical, and cruel. The war he entered upon was prompted mainly by ambition, and characterized throughout by the perpetration of atrocities so inhuman as to be almost incredible. In 1871 the allied powers imposed terms of peace on the country, under which it was reduced to utter impotency for future aggression; heavy war indemnities were levied, and the country was virtually dismembered. An internal revolution was attempted in 1874, which was suppressed by Brazilian troops, since which Brazil has assumed a sort of protectorate over the entire country.

The universal medium of communication is the Indian tongue—the Guaraní—which is used for ordinary purposes even by the few whites settled in the country. Even at the time of the war of independence there were at the utmost not more than 60,000 people of European descent in Paraguay, including the half-castes. All the rest were, and are to this day, pure-blood Guaranis. The Guaraní language is rich in vowels and euphonic in speech, but its vocabulary is meagre.

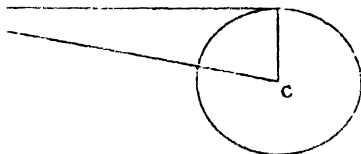
PARAGUAY, THE, a river of South America, which rises in lat. 13° S., in the province of Matto-Grosso, Brazil; flows south, forming part of the boundary between Paraguay, Brazil, and Bolivia, receiving on its right the Pilcomayo and the Vermejo, and joins the right bank of the Parana, after a course of about 1200 miles. In its upper course its banks are marshy, and it receives the waters of several extensive and shallow lakes. About lat. 21° a chain of heights crosses its course; south of this the marshy plains are replaced on the left bank by elevated land, though the right, or Chaco side of the river, is level and swampy throughout. The windings of the Paraguay are more frequent than those of the Upper Parana, and from its more uniform flow its value as a highway is greater. Large steamers from Monte Video ascend it to Curumba in Matto-Grosso, whence smaller vessels carry on goods to Cuyaba, in the heart of Brazil. The Paraguay swells

between February and June, and has an average rise and fall of about 15 feet in the year.

PARAGUAY TEA. See MATÉ.

PARAHÍBA, a maritime city of Brazil, capital of the province of the same name and the centre of its trade, is on the right bank of the river Parahiba, near its mouth in the Atlantic, 65 miles north of Pernambuco. It consists of a lower and an upper town, the former being the commercial quarter—one of the chief edifices of which is a government warehouse. In the upper town the architecture is antiquated, but the streets are wide and well paved. The public buildings of the whole city comprise Franciscan and other convents, several churches, prison, governor's palace, military arsenal, and treasury. The trade is chiefly in sugar, cotton, and Brazil wood. Near the city are coffee plantations. The population of the town and district is about 15,000.

PARALLAX. This word is used in astronomy to denote the angular change, in the place of a celestial body, which would be produced if the observer could transport himself to the centre of the earth. Let c be the centre

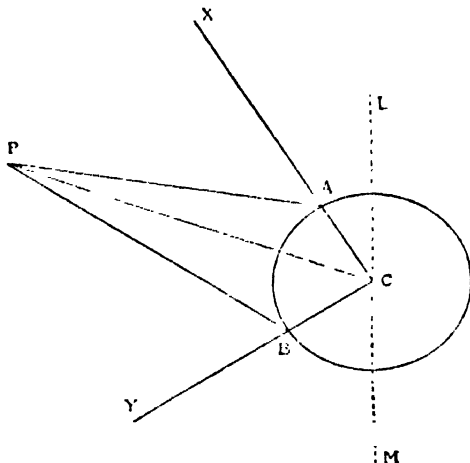


of the earth, and r the situation of an observer on its surface, and let r be the celestial body; then the angle $r P C$, subtended by the radius of the earth at the celestial body, is the parallax. It will be obvious that, supposing the distance $c r$ to remain the same, the angle at r will have its greatest value when the line $r r$ is a tangent to the earth, and under these circumstances the angle at r is called the horizontal parallax. The conception of horizontal parallax becomes somewhat facilitated if the observer imagine himself placed on the distant body r , and if he then look back at the earth. In this case, it is obvious that the horizontal parallax is simply equal to half the apparent angular diameter of the earth. Once the horizontal parallax has been determined, then the distance of that body becomes known, for in the right-angled triangle $c r r$ we know the angle at r , and we also know $c r$, being the radius of the earth.

Let $L M$ be the axis of the earth, and let r be the position of a celestial body. We shall suppose that an observer at A measures the angular distance of r from his zenith, and thus obtains the angle $x A r$; similarly another observer, supposed for simplicity to be on the same meridian, but at a very great distance B , determines simultaneously the zenith-distance $r B y$. The sum of the latitudes (one north and one south) of the observations at A and B , will give the angle $A C B$, while the lengths $A C$ and $B C$, being the radii of the earth, are of course known. It follows that everything relating to the quadrilateral figure $A r B C$ is determined, and thus the angles $A r C$ and $B r C$, and the length $r C$, are all known. (In practice, however, the process is a very much more complicated one than here supposed, for the two observations are not exactly on the same meridian, the observations can hardly be simultaneous, and the earth not being spherical, the zenith directions $A x$ and $B y$ do not exactly go to the centre.)

It so happens that the celestial bodies are generally so remote that there is only one to which this process will apply. Our nearest neighbour, the moon, has a horizontal parallax of very nearly one degree ($57' 27.07''$ is the mean value according to Stone), and this angle is quite large enough to allow of accurate measurement. The sun is

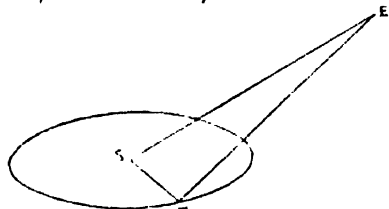
about 400 times as far off as the moon; the sun's horizontal parallax is thus somewhat less than 9 seconds ($8.78''$, Gill). The errors, unavoidable in measurements of the zenith-distance of the sun, would be very large in proportion to



the total amount in question, so that this method is inapplicable for finding the sun's parallax. Several other methods have been employed. One of the best known is that afforded by the transit of Venus, but there are others based on observations of the moon, and others again based on observations of Mars and of the minor planets, which are almost equally reliable. The distance from the earth to the sun being once determined, the distances of the planets from the sun, the distances of the satellites from their primaries, and the diameters of the sun and of the larger planets can be ascertained.

The diameter of the earth is, however, an utterly insignificant magnitude when viewed from the distance of the stars, so that this method is quite inapplicable. The annual movement of the earth around the sun provides a base line which in some few cases is long enough to enable the distance of the stars to be measured. The radius of the earth's orbit subtends at the star an angle known as the *annual parallax*.

Let s in the adjoining figure represent the sun, and r the earth, while E is a star; an observer situated at the



sun would see the star in the direction $s E$, while an observer on the earth would see the star in the direction $r E$. The position on the celestial sphere to which the star will be referred will therefore vary according as the position of the observer changes by the annual revolution of the earth round the sun. It is easy to show that the effect of annual parallax is to make the apparent place of the star trace out an ellipse. The major axis of the ellipse is parallel to the ecliptic, and the length of the axis will be unevenly proportional to the distance of the star from the earth.

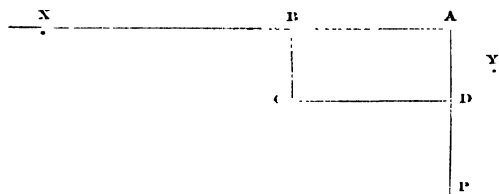
The determination of the distance of a star is thus re-

duced to the measurement of the angular value of its parallax ellipse. But the parallactic ellipse is so minute that in the majority of cases our ordinary methods of measurement fail to detect any considerable alterations in the positions of the stars which can be ascribed to this cause. Under these circumstances we infer that the stars in question are so exceedingly distant that the radius of the earth's orbit, great as that is, cannot be an appreciable magnitude when compared with the stellar distances.

It is, however, possible to arrange a method of observing by which much smaller parallaxes can be detected and measured than can be accomplished by meridian observation. Suppose there are two stars, of which one is considerably nearer to us than the other, while both stars are so nearly in the same visual ray that they appear close together in the heavens, each of the stars will, in consequence of annual parallax, appear to describe a small ellipse on the heavens, but the ellipse formed by the nearer of the two stars will be larger than that described by the more distant star. The apparent distance between the two stars and the direction of the arc joining them will therefore change, and the period of their changes will be a year. All irregularities from the instrument will affect the two stars nearly in the same manner, and the refraction can be accurately allowed for.

An annual parallax of even one second would require that the star should be distant from us by 206,265 times the radius of the earth's orbit. The actual distance of the stars from the earth would therefore amount to about 20,000,000,000,000 miles. So far as we know at present it appears that a sphere of which the earth was the centre, and of which the radius was 20,000,000,000,000 miles, would hardly contain a single star. There are several stars of which the parallax has been determined. The nearest of all seems to be α Centauri, with a parallax of nearly one second. In the Northern hemisphere the nearest star appears to be β Cygni, with a parallax nearly half a second; and it seems probable that there is another star in the same constellation with a parallax of about the same amount. Vega has a parallax of only $0.18''$, and other bright stars are more distant still.

PAR'ALLEL MOTION, a contrivance of Watt in the construction of the steam engine for changing a reciprocating circular motion into a reciprocating rectilinear motion.



For instance, let $A B X$ be one end of the beam of a stationary engine, the centre of the beam being at x . Then when the beam rocks on its centre the points A, B will describe arcs of circles on x as a centre; consequently if A, P , the piston-rod, were attached to the point A it would be exposed to a strain alternately towards the right and towards the left, since the piston-rod can move vertically only. Now take A, D, B, C , two rods of equal length, and attach them by joints to the points A, B , and let the piston-rod P be attached by a joint to D instead of to A ; also attach by joints the rod C, D to the points C, D , this rod being equal to the distance $A B$; finally, let C be attached by a jointed rod to a fixed external point, x , the distance and position of which requires adjustment on considerations too detailed to be here set down. It is manifest that the joints A, B play in arcs the convexity of which is to the right hand, since their centre is x ; but the joint C (the

"link") plays in an are the convexity of which L_3 to the left, since its centre is the fixed point x , to which it is attached by a jointed rod, $c \cdot y$ (not shown in the diagram). In fact it is so arranged that c shall move in one swing as much to the right, when the apparatus is set going, as A shall move to the left. Now when this is the case it is evident that the stress thrown on the point D by A , which seeks in the upward stroke to drag it to the left, is neutralized by the pressure of c , which throughout the stroke is always seeking to thrust it to the right. The action is exactly reversed during the downward stroke. The result is, the point D moves neither to right nor left, but simply in a vertical line. To be quite accurate, it really describes an elongated figure 8, or what is called in geometry a *lemniscate*; but in well-adjusted mechanisms the difference from a straight line is practically insensible.

Another form of parallel motion is White's, consisting of two spur-wheels, one of which rolls within the other, the diameter of the smaller wheel being half that of the larger. The result of such an arrangement is that a point on the circumference of the smaller circle will trace out a diameter of the larger circle, and a rod jointed to such a point will move in a straight line along the diameter as the larger circle revolves.

PARALLEL OGRAM is the mathematical term for a rectilinear four-sided figure of which the opposite sides are parallel. It follows, as is demonstrated in any geometrical treatise, that the opposite angles are equal; and further, that the four angles together are equal to four right angles. If therefore one of the angles of a parallelogram is a right angle, it follows that all are right angles (rectangular parallelogram), and this figure is called, for shortness, a *rectangle*. Rectangles have the adjacent sides equal (*square*) or unequal (*oblong*). If a parallelogram be not rectangular it is a *rhombus* (adjacent sides equal) or a *rhomboid* (adjacent sides unequal). The lines dividing a parallelogram in half, running between opposite corners across the figure, are called its *diagonals*. The diagonals bisect each other in the *centre* of the parallelogram, and the sum of their squares is equal to the sum of the squares of all four sides of the parallelogram.

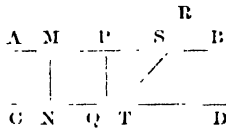
PARALLEL OGRAM OF FORCES and VELOCITIES. See COMPOSITION OF FORCES, &c.

PAR'ALLELOPI'PED (often, and with great correctness, written *parallelepiped*) is the name given to a solid contained by six parallelograms, which are equal and parallel, two and two. It is in fact a quadrangular prism. When all the parallelograms are rectangles, we have one of the figures to which our eyes are most accustomed, as in the case of a die, a box, a plank, a room, &c. Persons not acquainted with mathematics would hardly believe that English mathematicians seldom express this most simple and elementary of all solids in less than ten syllables, as follows, "rect-an-gu-lar par-al-lel-o-pi-ped."

A more simple term might easily be obtained, and one perfectly consistent with analogy, namely, *right solid*. Thus a right line might be conceived as generated by the most simple motion of a point; a right surface (or rectangle) by the most simple motion of a right line; and a right solid (or rectangular parallelepiped) by the most simple motion of a right surface. When the adjacent rectangles of a right solid are squares, the solid is a cube, for which fortunately there is a shorter term than "equilateral rectangular parallelepiped." The number of cubic units in a parallelepiped is found by multiplying the number of square units in either base by the number of linear units in the perpendicular distance between that base and the opposite one.

PAR'ALLELS (Gr. *parallēla*, by the side of each other), the name given by the Greek geometers to lines in the same plane having that relation of situation of which it is one of the most obvious properties that such lines never meet, however far they may be produced or lengthened.

If we examine the properties of lines experimentally, it will be easy to satisfy ourselves of the existence of such pairs as $A B$, $C D$, which neither diverge nor converge, and



to which common perpendiculars, such as $M N$ and $P Q$, all of the same length, can be drawn through any point of either. Moreover, the angles RSB and RTD , made by the same line with both, will be found to be the same. If, then, we take the notion of permanence of direction, which always accompanies that of straightness, and also the notion of differing directions, which is suggested by two lines which make an angle, we may readily see that the relation of situation, which, adopting Euclid's term, may be called parallelism, is really that which would be also conveyed by the words "sameness of direction;" so that if two lines, A and B , be parallel, A may be substituted for B , or B for A , in any proposition which involves relations of direction only, without affecting the truth of that proposition, if true, or its falsehood, if false.

Geometry, as every beginner knows, depends upon a small number of self-evident truths, or rather of propositions the truth of which (with one exception) is so soon and so easily perceived, that no one doubts of them when stated with ordinary attention to clearness of expression. The exception alluded to appears for the first time in Euclid, and has been the occasion of a controversy which has lasted from his time to the present.

It will be remarked that the definition of parallel lines is purely negative; it describes what they are not, not what they are: if lines which meet be called intersectors, parallels are *non-intersectors*. Those who would found geometry upon definitions entirely, may think that the difficulty of the theory of parallels arises from insufficient definition; but those who believe it to be deducible from real and positive conceptions, having nothing arbitrary about them, must suspect that, in this purely negative definition of parallels, we have not sufficiently described that very obvious relation of position which distinguishes parallelism from convergence, however short the lines we imagine to ourselves, or however little we think of what will take place if they are produced. Euclid, proceeding upon axioms the admission of which is not considered to be a question connected with the present difficulty, establishes the following proposition:—If the two lines $S B$ and $T D$ make the angles $P S T$ and $S T D$ equal, or $R S B$ and $S T D$ equal, or make $B S T$ and $S T D$ together equal to two right angles (all which amount to the same thing), then $S B$ and $T D$ are *non-intersectors*. But before any further step can be made, it must either be proved or assumed that in every other case they are intersectors, and Euclid, being unable to prove it, assumes it. That is to say, he requires it to be granted that if $B S T$ and $S T D$ be together less than two right angles, $S B$ and $T D$ will meet, if produced, and on that side on which they make, with $S T$, the angles less than two right angles. The last clause is not a necessary part of the axiom, since it can be shown, independently of the present theory, that two lines which meet must make angles together less than two right angles with any line which cuts them internally.

Euclid obviously puts the whole difficulty into an assumption, which, though the most direct course, is not that which is best calculated to give the highest degree of evidence to geometrical truths. For it is a more obvious proposition that two lines which intersect one another cannot both be parallel to a third line; and this being granted, Euclid's axiom readily follows. If it should be objected

that this is merely Euclid's twelfth axiom in another form, it is replied that the form is a more easy one, and therefore preferable; just as it would be wiser to assume "Every A is B and every B is A ," than the identical but more complicated proposition "Every A is B , and everything which is not A is not B ."

It is known, then, that the difficulty is entirely removed if we grant, with Playfair, that "two lines which intersect are not both parallel to any third line," or, which is the same thing, with De Morgan, that "through a given point not more than one line can be drawn parallel to a given line." The theory of Euclid is thus improved as far as it is capable of being done by a mere difference of statement. Potts's solution of the difficulty is as follows:—"Parallel lines are such as lie in the same plane, and neither recede from nor approach to each other." The reality of the difficulty is shown by no less than thirty solutions, by eminent men, given in Colonel P. Thompson's "Geometry without Axioms."

PARALYSIS or Palsy (Gr. *paralucin*, to relax) is the diseased condition in which the natural power of sensation or motion is lost in any part of the body, owing to some interruption to the nervous mechanism by means of which such power is exercised. There are very many varieties of paralysis, but in medical practice they are generally grouped into three divisions:—(1) Cerebral, depending upon disease of the brain; (2) spinal, in which the disease is located in some portion of the spinal cord; and (3) peripheral, where the cause is found in the morbid condition of some one or more of the nerve-trunks distributed in special parts or organs.

Of the forms of paralysis due to brain disease the most common is that which is called technically *hemiplegia*, or in common phraseology "a paralytic stroke" (from the Greek *hemi*, half, *plegia*, a stroke or blow). This usually arises from some affection of the hemisphere of the brain opposite to the side of the body affected, such affection being in the form of hemorrhage into the brain substance, or of softening in one of the corpora striata. The onset of the disease may be ushered in by an apoplectic fit followed by a prolonged period of unconsciousness; but more generally, though the attack comes suddenly, the patient experiences no loss of consciousness nor feels any pain, the loss of power in the parts affected being the principal symptom observed. There is usually no decided mental disturbance, but there is almost invariably the more or less complete loss of voluntary power over the arm and leg of the side implicated, and there is some loss of power over the muscles of the face. Sensation in the paralysed members is at first impaired, and the parts feel numb as well as useless, while occasionally they become fixed and rigid. In slight cases the loss of power over the facial muscles, causing thickness of speech and imperfect mastication, soon disappears, and after a time symptoms of amendment are noticed in the limbs, the recovery of power being first observed in the leg rather than the arm, and in the joints nearest the body rather than those more distant. Sometimes the recovery appears to be complete, but in the majority of cases a permanent weakness of the affected muscles is left. The particular combinations of symptoms met with in different cases of hemiplegia vary in an almost endless manner according to the situation and extent of the injury in the brain. Thus the paralysis may be worse in the leg than in the arm, or the arm may be alone affected; there may be impairment of speech and some amount of facial paralysis, while the arm and leg may be unaffected; or the paralysis may be present in one or both extremities of one side while the other symptoms are absent.

The forms of paralysis which are of spinal origin usually commence without convulsions or impairment of consciousness, though like those arising from brain disease they may be either sudden or gradual in their mode of onset. Both

sides of the body are usually affected, the legs and lower portion of the trunk being generally implicated. In the most common form of this disease, known as *paraplegia*, the sensations generally noticed first are those of weakness and numbness of the feet and legs, and this weakness increases until there is complete loss of sensibility and motion of the lower extremities, with perhaps some affection of the bladder or bowels. Until sensibility is lost the patient, though unable to move his legs, may yet suffer from painful spasmodic twinges and startings, especially at night. When the affection is prolonged, the nutrition of the paralysed parts becomes impaired, and there is a retention of urine and loss of power over the evacuations. There is also a special liability to the formation of bed-sores, which prove very intractable and difficult to heal. Occasionally recovery takes place, but in general this is incomplete, and in many cases the patient, after lingering on for a few years, succumbs to some incidental complication of his disease.

Another form of spinal paralysis, often showing itself as *paraplegia*, is that known as *infantile paralysis*. The causes of this affection are somewhat obscure, but it is most common during the period of first dentition, though not limited to that period. Its onset is often quite sudden in the midst of what appears to be perfect health, though it is usually preceded by feverishness and accompanied by convulsions. The lower extremities are generally the first invaded, and sometimes the upper extremities are involved also. After a time the paralysis becomes more limited, and is confined to one or other limb, or even to one group of muscles, and the paralysed portions become liable to much wasting and degeneration. In consequence a variety of deformities and unnatural attitudes ensue, calling for the skill of the surgeon. Happily, in the case of infantile paralysis, the bladder and bowels are seldom affected, and the general health of the child may remain fairly good. In many instances, too, there is a gradual recovery, and ultimately the disease wholly disappears.

Facial paralysis, or as it is sometimes termed, "Bell's palsy," is a variety of paralysis in which only the muscles of the face are affected, arising from disease or injury to the seventh pair of nerves. It is sometimes apparently the result of exposure to cold, but it may arise from curies, syphilis, rheumatism, inflammation, or direct injury to the nerve itself. The onset of facial paralysis is usually gradual, occupying from a few hours to three or four days in its development. Almost invariably one side only of the face is affected, and the patient thus presents a very peculiar and striking expression. At rest, one side of the forehead appears smooth and the mouth is drawn down a little at the corner, while the eyelids cannot be brought together, and the eye remains open even in sleep. During movement the difference between the two sides of the face is still more strongly marked. One side may display all the usual modes of expression, while the other remains blank and motionless. The patient cannot whistle or even blow out a candle, for he is unable to purse up his lips sufficiently for that purpose, and for the same reason he is unable to spit. His taste is very much impaired, and in eating the food accumulates between the jaws and the cheek on the affected side, while drink has a tendency to run out at the corner of the mouth. Usually sight is unimpaired, and the patient is able to speak without difficulty; but the articulation of such words as are formed by the lips is necessarily affected. The majority of cases of facial paralysis are due to rheumatic affections of the nerve, and the disease yields readily to treatment in a few weeks, even when the cause is debility or recent syphilis. The prognosis is good, but where the disease arises from cerebral or intercranial lesions the prospect of cure is doubtful.

Shaking palsy, or *paralysis agitans*, is chiefly an affection of old age, and is characterized mainly by tremors of the limbs occurring independently of muscular exertion,

rigidity of muscles, and a tendency in walking to bend the trunk forward and pass into a running pace. It generally comes on insidiously, beginning with occasional tremors in the hand or foot, which increase in frequency, duration, and severity until, it may be, all the limbs are implicated. As the disease progresses, a rigidity of the muscles attended with cramp-like pains is observed, and from the first there is a great sense of weariness and depression. The disease is one of slow and often irregular progress, and it may take several years to reach its full development. Occasionally it is recovered from in the early stage, but more generally it proves incurable, and results in the death of the patient. Somewhat similar in its symptoms is the disease known as *mercurial paralysis* or *tremor*, which is caused by long-continued exposure to the fumes of mercury. In this disease, which may come on suddenly or gradually, the upper limbs are first affected, and then by degrees the whole muscular system. The effect of the tremors is to deprive the patient of the power to guide his muscles, so that, for instance, he cannot put a glass of water to his lips, he cannot put his feet steadily to the ground, and when he attempts to walk he breaks into a short dancing trot. The complaint is seldom fatal, but it is one that is very difficult to cure. *Lead paralysis*, arising from the absorption of lead into the system, has already been noticed under LEAD POISONING.

The treatment of the various kinds of paralysis must depend on the nature of the lesion which produces them, and is consequently very varied. In every case, the best medical advice obtainable should be sought, and the remedial measures adopted must be steadily and patiently followed up if a good result is to be obtained.

PARAMAGNETISM. When Faraday discovered that all bodies are subject to magnetic influence, instead of only the limited class commonly called magnetic (iron, nickel, cobalt, &c.), he invented the words *paramagnetism*, to express what one might call the magnetic transparency of the bodies called "magnetic," and *diamagnetism*, to express what one might call the magnetic opacity of other substances. Paramagnetic bodies (iron, nickel, cobalt, &c.), if suspended in air, tend to move to those parts of a magnetic field which are at the greatest intensity; diamagnetic bodies (as bismuth, &c.) move in exactly the opposite manner, to parts of the magnetic field which are at the least intensity.

PARAMARIBO, the chief town of Dutch Guiana or Surinam, in South America, situated at the mouth of the Surinam River. It is well and regularly built, in spacious streets crossing at right angles, and generally with planted avenues, and has several Roman Catholic and Protestant churches, two synagogues, a governor's palace, a town-house, theatre, an orphan asylum, a military hospital and barracks; and an extensive trade, both export and import. The town is well drained, but the climate is very humid, and *Elephantiasis arabum* and *lepra* abound among the natives in the vicinity. The population is about 23,000.

PARAMATTA, a town of Australia, in New South Wales, situated on the Paramatta River, which is a prolongation of Port Jackson. Next to Sydney, 14 miles east, it is the oldest town in the colony, having been founded under the name of Rosehill in 1788. Much of the early history of the colony is bound up with Paramatta; the first grain was grown and harvested here, and the earliest grants of land to convicts who had served their time were made. The town has many features of interest; it is well laid out, and is not altogether unlike an English town of the same size. The public buildings are numerous, and comprise the Government House, two hospitals, two lunatic asylums, asylum for the infirm and destitute, Roman Catholic and Protestant orphan schools, court-house, and two Episcopal, two Wesleyan, one Primitive

Methodist, one Presbyterian, one Roman Catholic, one Baptist, and a handsome Gothic Congregational church. There are also some twined manufactories, a brewery, tile works, soap and candle factory, and a Benevolent Society. The King's School is the oldest grammar school in Australia, having been founded in 1832. A beautiful park is reserved for the recreation of the inhabitants. The population in 1881 was 8433. The district is mainly devoted to fruit-growing, and the orangeries and orchards of Paramatta have wide reputation.

PARAMETER, a term employed in CRYSTALLOGRAPHY. The imaginary axes of crystals all pass through a common centre, and that part of each axis between the centre and the surface of the crystal is termed a *parameter*.

PARAMORPHS. See PSEUDOMORPHISM.

PARANA, a town in the province of Entre Rios, Argentine Republic, situated on a plateau on the left bank of the river Parana, 90 miles N. of Rosario. It is a flourishing town and river port, the latter connected with the town above by trainway. Its lime-kilns supply the towns of La Plata. The governor's palace, several churches, and a theatre, are the chief buildings. The population is about 11,000.

PARANAPHTHALENE. See ANTHRACENE.

PARAPEPTONE, the name given to the precipitable part of the proteids in digested food, *peptone* being the name given to the proportion which obstinately remains in solution.

PARAPET (Ital. *parapetto*), a low or breast-high wall or fence, to serve as a protection on bridges, terraces, platform-roofs, &c. In Italian architecture parapets are generally balustrades. In Gothic architecture the roof parapet is merely a continuation of the wall carried up above the edge of the roof, and finished by a coping; unless machicolated, in which case it projects and overhangs the walls below. In the Lombardic buildings of Italy there is seldom any roof-parapet, the eaves of the roof finishing the elevation. The same is frequently the case in the Norman style. In Venetian and also in Elizabethan buildings open-work parapets, forming various fantastical devices, are common. Parapets are often in the form of battlements. See BATTLEMENT, and the illustrations in that article.

PARAPHERNALIA. This term comprehends the dress and ornaments of a wife which she occasionally wears, and which she is entitled, under some limitations, to retain after her husband's decease. It cannot be accurately stated how much a wife may claim as her paraphernalia, for this will depend on the rank and fortune of the husband and wife. Unlike her separate property, a wife's paraphernalia may be disposed of by her husband during his life, though he cannot bequeath them to a third person. In Scotland the paraphernalia include clothing, trinkets, and furniture belonging to a married woman; and the husband has no property in them whatever, nor can his creditors claim them in payment of his debts. The term and the theory are borrowed from the Roman law.

PARAPHRASE (Gr. *para* and *phrasis*), the free translation or rendering of a passage into different and fuller phraseology, so as to make its meaning clearer, or give greater force to the idea which it conveys. A translation from a foreign author implies that his language will be closely followed; a paraphrase, that his thoughts and their general arrangement will be adopted, but the mode of expression altered at the will of the paraphrast.

PARAPLEGIA is paralysis of the legs, or of the legs and pelvic viscera together. See PARALYSIS.

PARASELENE (Gr. *para*, near, and *selénē*, the moon). This name is given to the ill-defined and faintly luminous discs which occasionally appear in halos surrounding the moon, as the corresponding but brighter spots which are seen in halos about the sun are called *parhelia*. See HALO.

PARASITE, a Greek word for sycophant (*para*, beside, *sitos*, food; he who feeds by one's side, and therefore at one's expense): very much what we call a "hanger-on."

PARASITES, ANIMAL. Parasitism, in its broadest sense, may be defined as the dependence of one species upon another for food or shelter. It is not confined to worms, as was once supposed, but nearly every group of the animal kingdom contains some parasitic forms. Parasitism may be temporary or life long, and likewise the dependence upon the host may be of all degrees. Some parasites, to which the less odious name *messmates* or *commensals* has been given, seek only from their host a place at his table, as it were, and inflict on him no injury beyond sharing his food—in some cases, indeed, conferring on him benefits in return. The echinoderms known as holothurians play the part of hosts to a number of messmates. Fishes belonging to the genus *Pteraster*, allied to the launces of our own coasts, shelter themselves within the respiratory cavity of the holothurian; two or more pea-crabs (*Pinnotheres*) take up their quarters in the interior, and other crabs are often found on the outside of the body. A remarkable mollusc (*Entacmaea mirabilis*) has also been found within the body of holothurians, but whether as messmate or parasite is not known. Hermit-crabs often carry on their stolen mollusc shells a whole colony of sea-anemones and polyps, while marine worms and cirripedes are found inside the shells. In some cases the association between host and messmate is of a more permanent character, the latter losing their organs of locomotion and often of sense, and casting in their lot for life with the hosts who give them shelter. Such are the cirripedes, found on whales, crabs, gastropods, &c.

True parasites, or those which feed on their host's body, may be divided into external and internal parasites, Epizoa and Entozoa. The Epizoa consist of animals which infect the skin of their host, sucking his blood. Many insects are epizoa, as the mosquitoes, fleas, lice, and bugs, all of which attack man and other mammals and birds. Many mites are also external parasites. The Entozoa or internal parasites are those to which the greatest interest attaches. Till very recent times it was confidently believed that all parasites originated by spontaneous generation. Helminthology, or the study of parasitic worms, has now become a science, and the wonderful life-history of all the common parasites of man, as well as many of those of other animals, has been carefully traced out. It is now known that while all parasites, like all other animals, take their origin from an egg, many of them undergo the most marvellous migrations and transformations before they become mature and reproduce their kind. As in the case of commensalism, so in true parasitism there are all degrees. In many parasites the male is free all his life, but the female, while free when young, seeks a host when she becomes sexually mature. Such are chiefly epizoa, as the leishmans and fish-lice. Many parasites, especially the tape and thread worms, have two hosts. The intermediate host is generally an herbivorous animal, which swallows the parasite either in the egg or when still young. The final host is always some carnivorous animal, whose special prey is the intermediate host, and which swallows with it the contained parasites. The parasite on reaching its final host generally undergoes a change of form and becomes sexually mature, inhabiting now chiefly the alimentary canal and its outgrowths, so as to provide for the ready exit of the eggs. In some cases the parasite becomes sexually mature in its first host; others, as the *Trichina spiralis*, make their way to a different part of the host's body and there become mature. When, as in certain thread worms, the whole life-cycle is passed within one host, the *ne plus ultra* of parasitism is reached.

Parasitism is but a special case of the unceasing adapta-

tion of organism to environment, leading to degeneration instead of progress. A parasite living within the alimentary canal of its host has no need of special organs of any kind, even a mouth and alimentary canal becoming useless. At the same time its complete dependence on different hosts at different times of its life increases enormously the risk of failure to leave offspring; so that we find in many cases the reproductive function unusually active.

Most parasites are introduced into the system through the medium of food and drink. The most dreaded of man's parasites, the Trichina and the tapeworms, are introduced in meat insufficiently cooked. Eggs are laid by certain parasitic flies within the reach of the tongue of horses, by which means they are conveyed into the stomach. Other insects, as the ichneumon-flies, pierce the body of caterpillars and insert their eggs.

The special parasites of man amount to about sixty or seventy, but the presence of many of these is perfectly compatible with good health. One of the most terrible is the *Trichina spiralis*, which causes the disease known as Trichinosis.

VEGETABLE PARASITES have attracted attention from the earliest times, though it is only of late years that the subject has been accurately investigated. At one time such plants as ivy were included in the class, though it merely clings to a tree without penetrating to its tissues and living on its substance. Several kinds of orchids, too, as well as other plants, grow on trees without attacking their juices, and all such plants are called *epiphytes*. Other plants grow in soil which is mainly composed of decaying vegetable matter. They are closely connected in general structure and appearance with the true parasites, and the limit between them is obscure, for a plant may at one period of its life-history obtain its food supply from the tissues of a living plant, and at another may be living on decaying protoplasmic matter. However, they may be kept apart as a physiological group, and were first named as a distinct group by De Bary, under the title *saprophytes*. De Bary also found it necessary to invent the word *symbiosis* to express such a connection between two plants as occurs in lichens, where, according to Schwendener's theory, an alga and a fungus consort together, not preying one upon the other, but each supplying peculiar nourishment to its messmate.

A vast number of fungi are parasitic, and cause an immense deal of damage; thus, the salmon disease is caused by a minute fungus called *Saprolegnia ferax*, the potato disease by *Phytophthora infestans*, and the coffee-leaf disease by *Hemileia vastatrix*.

Among flowering plants may be mentioned the mistletoe, dodder, broomrape, cow-wheat, rattle, eye-bright. The first two plants just mentioned attack the stems, while the others attack roots. There are instructive differences in the degree of parasitism of these plants. The cow-wheat, rattle, and eye-bright have well-developed roots, and an abundant supply of chlorophyll, and yet the cultivation experiments of Decaisne and Cornu show that parasitism is necessary. The mistletoe has also chlorophyll, and can thus take the carbon from the carbonic acid of the air, and use it as food in forming its own substance, though it is dependent for the mineral and nitrogenous part of its food upon the host. The dodder germinates in the ground, but probably does not derive any nourishment from the soil, for as soon as it appears above ground it twines round some neighbouring plant, and penetrates its tissues by means of suckers. It is carried up out of the ground by the growth of the host, and depends upon it for its whole supply of food, being without leaves, and having no chlorophyll in any part. The broomrape, in the same way, is of a brown colour, due to the absence of chlorophyll, and is very destructive to clover and other plants. Parasitic plants belong to various natural orders, and all

the species included in the orders Rafflesiaceae and Balanophoraceae are parasitic.

PAR'CE, the Latin name for the FATES.

PAR'GENERS, or **COPAR'GENERS**, are so called because the lands of which they are parceners may be partitioned or divided among them. They may be parceners by common law and parceners by custom.

As to parceners by common law, if a man dies intestate seized of lands in fee, and leaves only daughters, the lands will descend equally to all the daughters, or if he has no daughters and no brothers, the lands will descend equally to all his sisters, if he has any; and if there are no nearer heirs, the lands will descend to his aunts. The descent is the same if a man dies seized of lands in tail, except where the estate tail was limited to such man and the heirs of his body, for in that case the lands can only descend to those who are heirs of the body. In all cases where several females take one inheritance by descent, they are called parceners; and all lands or tenements, including a rent charge, may descend in this manner. If there be a title of dignity descendible to heirs of the body, the lands and tenements belonging to it may descend to parceners; but the dignity itself does not descend, for all the parceners only make one heir, and a title of dignity is not in its nature divisible. The dignity therefore will be in abeyance. The descent of the crown is an exception to this rule; for if there are several daughters, &c., and no male heir, the crown with all its rights descends to the eldest female.

Parceners may voluntarily make partition of their lands; and any one may compel a division by a suit in equity.

The law of Scotland on this subject is similar to that of England, though certain differences are traceable. Any of the *heirs portioners*, as parceners are styled in Scotland, may compel division of the property, and the eldest has the portion nearest the mansion house; the others cast lots for their choice. The eldest heir-portioner is entitled to such peerages or dignities as are not otherwise limited; she is also entitled to the mansion-house of a country estate, but not to a house in town or a country villa. In this kind of succession the right of representation prevails. Thus if A dies leaving two daughters, and also grandchildren by a deceased daughter, the eldest grandson, as his mother's heir-at-law, will succeed to her share of A's heritage, to the exclusion of his brothers and sisters.

PARCH'MENT consists of the skin of sheep, lambs, goats, or calves prepared for writing upon, bookbinding, &c. The skins employed, after being unhaired and cleaned by processes similar to those employed in the manufacture of LEATHER, are stretched on a square wooden frame called a "herse," and drawn tight by pegs. They are then carefully gone over with a fleshing knife, both sides being well scraped, and the skin, if wanted for drum-heads, is then simply allowed to dry gradually upon its frame. If it is intended for writing purposes or for vellum, it is powdered with chalk upon the flesh side, and carefully rubbed with pumice stone until a smooth even surface is obtained. The grain side is also rubbed down with pumice stone until all inequalities are removed, and the skin, still tightly stretched, is allowed to dry slowly in its frame. Sometimes these operations have to be repeated several times in order to secure a fine surface on the material. Stout vellum is prepared from calf skins, split sheep skins being used for ordinary qualities. For drums, tambourines, battle-dores, &c., goat and calf skins are used, though the best drum-heads are said to be prepared from the skins of wolves. An enameled parchment used for writing tablets is also prepared from asses' skins.

The name parchment is a corruption of the Latin *pergamena*, from Pergamos, where it is said to have been invented by the king, Eumenes II., who reigned from 197 to 159 B.C. It was used, however, as a writing material long before that time, especially in Egypt. In the British

Museum are rolls of brown leather and white parchment of nearly 1000 years earlier date. Possibly the Pergamian invention was an improvement in the preparation of skins, which had certainly been used centuries before.

PARCHMENT, VEGETABLE. This remarkable substance is a modified form of paper produced by chemical treatment, which resembles animal parchment so closely as to require minute inspection to distinguish the difference. It is made from the water leaf or *unsized paper*, by immersing it for a few seconds in a bath of sulphuric acid, diluted with one half water, at the temperature of the ordinary atmosphere, and immediately washing away all trace of acid. The alteration which has then taken place in the paper is very remarkable, for, though no chemical change is effected, nor is the weight increased, a molecular change has placed the material in a transition state between the cellulose of woody fibre and dextrin. It has also acquired a horny parchment-like appearance, and about five times the strength of ordinary paper. It will bear exposure to wet without injury, and it is unaffected by boiling it in water. A process for the preparation of vegetable parchment was patented in 1857 by Mr. W. E. Gaine, and machinery was designed and adapted for the manufacture by Messrs. De la Rue and others. In the ordinary process, a web of paper is passed through a vat containing the diluted sulphuric acid, in which it remains from five to twenty seconds at a temperature of about 60° Fahr., after which it is passed in succession through pure water, a weak ammoniacal solution, another bath of water, and it is then dried by means of felted rollers and heated cylinders. Another method of obtaining vegetable parchment consists in submitting the paper to the action of a syrupy solution of zinc chloride at a temperature of from 120° to 212° Fahr. Vegetable parchment is now a regular article of trade, but it has failed to take the place of animal parchment to the extent at first anticipated. For tracing of plans, charts, &c., it is useful, as it can be made very thin, and it is sometimes used for the engrossing of legal and other documents, but its chief use is for covering pots of pickles and preserves.

PARDON. According to the law of most countries, a power of pardoning, or remitting the penal consequences of a conviction for crimes, is vested in some person. The utility of such a power has been doubted, upon the ground that it supposes an imperfect system of criminal law, and that every instance of its exercise is the proclamation of an error either in the law itself or in the administration of justice (Beccaria, chap. 46). There is no doubt that the nearer a penal system approaches to perfection, the fewer will be the occasions for resorting to extraordinary remissions of the execution of the law; but considering the numerous causes of erroneous decision, arising not only from the imperfection of laws themselves, but from the infinite sources of error in the instruments and means by which they are administered, it seems to be desirable that some power should exist which may correct error in cases where it cannot be corrected by any appellate tribunal. At the same time it is evident that such a power should be circumscribed and defined, as far as its nature will admit, and exercised with the utmost caution. By the law of England, besides pardons by Act of Parliament, the power of granting pardons for crimes is exclusively vested in the king as a branch of his prerogative.

The crown has, however, no power to pardon any offence in the prosecution of which a subject has a legal interest. Thus in indictments for common nuisances, where the public are interested as individuals or particular classes, or informations upon penal statutes, where the penalty or any part of it goes to the informer or the party grieved, the crown cannot pardon the offender. By the Act of Settlement, 12 & 13 William III. c. 2, it was enacted "that no pardon under the great seal of England shall be *pleadable*

to an impeachment by the Commons in Parliament." This statute does not affect the power of the crown to pardon the offender after he has been found guilty upon the impeachment and the proceedings are determined.

A pardon may be either absolute or subject to any condition which the crown may think proper to annex to it. In former times, in the criminal law of England, almost all felonies were nominally capital; and in the numerous cases where it was not intended that the sentence of death should be executed, the criminal obtained a pardon upon condition of his submitting to transportation or some other punishment. At present, where the crown interferes to mitigate or commute a sentence, the mode by which it is effected is by granting a conditional pardon. The effect of such a pardon is not merely to prevent the infliction of the punishment, but to restore the legal capacity of the offender.

If it has been found that a prisoner has been wrongfully convicted of any criminal offence, he receives the sovereign's "free pardon"—a process which amounts to an acknowledgment of the prisoner's innocence. For the injury, however, which may have been thus inflicted upon a man through the fallibility of the law, there is no legal redress; and it was a notable departure from the ordinary course in such instances when, in 1879, the government offered some measure of compensation to Habron, who three years before had been wrongfully convicted and sentenced to death on charge of a murder which proved to have been committed by another person.

PAR'DUBITZ, a town of Bohemia, in the circle of Chrudin, on the small river Chrudimka, possesses an old castle, several churches, a high school, three hospitals, and manufactures of paper and articles in iron and copper. The river, at its junction with the Elbe, is here crossed by a bridge, 13 miles south by west of Koniggratz. During the last Prusso-Austrian War the town was captured by the Prussians, 6th July, 1866, and the city of Prague and all the fortresses of the northern part of Bohemia were thus cut off from the rest of the Austrian Empire. This blow fell heavily on the Austrian forces, and compelled Marshal Benedek to retreat rapidly upon Olmutz to cover Vienna.

PARÉ, AMBROSE, the first and most eminent of the old French surgeons, was born in 1509 at Laval, in the province of Maine and the modern department of Mayenne. His parents were poor, and his education was neglected; but having one day witnessed the operation of lithotomy, he went immediately to Paris and commenced the study of surgery. He afterwards accompanied the French army during several campaigns in Italy, and gained so much reputation that in 1552 he was appointed surgeon in ordinary to King Henry II. He held the same office under Francis II., Charles IX., and Henry III., until his death at the age of eighty-one, in 1590. The French writers justly consider Paré to be the father of modern surgery, and say that he holds the same rank in this branch of the profession as Hippocrates does in medicine. He was not satisfied with blindly following the precepts of his predecessors, but by diligent observation and reflection made several important changes in the mode of treatment, which have been followed to the present day.

PAREGORIC or **PAREGORIC ELIXIR** is the name given to the camphorated tincture of opium which is largely used as a pectoral and anodyne in cases of troublesome coughs, &c. It is composed of opium, benzoic acid, camphor, oil of anise, and proof spirit, there being in each drachm one-quarter grain of opium, the dose being from 15 to 60 minims. *Scotch Paregoric*, or the ammoniated tincture of opium, should be composed, according to the Edinburgh Pharmacopœia, of opium, saffron, benzoic acid, oil of anise, strong solution of ammonia, and rectified spirit. It is a much stronger preparation than the English, 80 minims containing about one grain of opium.

PARENCHYMA is the term used by botanists to signify the cellular tissue of plants in which the cells are of the same breadth as length, or not much longer than broad, with ends that are blunt and not tapering, as in piosenchyma.

PARENT AND CHILD. The reciprocal duties of parents and children, from the legal point of view, are chiefly those of maintenance. Parents are bound to maintain their legitimate children who are unable to maintain themselves owing to infancy or inability to work. This obligation extends to father and mother, grandfather and grandmother, if they are able to perform it. But such persons are only legally bound to furnish the necessities of life, and by 43 Eliz. c. 2, the amount required for this is fixed at 20s. per month. A husband is liable to maintain the children of his wife born before marriage until they are of the age of sixteen, or until the death of his wife. By the Married Women's Property Act of 1882 a wife owning separate property is made liable with her husband for the maintenance of her children and grandchildren, but the possession of property by the wife does not free the husband from any legal responsibility in this respect. Any parent wilfully neglecting to provide adequate food, clothing, lodging, or medical aid for his child under fourteen years of age, to the injury of its health, is liable, under 31 & 32 Vict. c. 122, to fine and imprisonment. Parents were not formerly legally bound to give any education to their children, nor were they under any restrictions as to the kind of education which they gave, but the law in this respect was altered by the compulsory clauses of the Education Act of 1870.

Parents are not bound by English law to make any provision for their children after their death, and a parent may by will deprive his child of any share in his estate, real or personal.

The power of a father over his children continues until the age of twenty-one. If a parent die, leaving a child under age, he may appoint a guardian to such child till the age of twenty-one. A child under age may acquire property by gift; and if a father is the trustee of his child's estate, he must account to the child when he comes of age, like any other trustee. So long as a child who is under age lives with and is supported by the father, the father is entitled to receive the reward of the child's labour. When a child has a fortune of his own, and the father is not able to maintain him suitably to such fortune, the Chancery Division of the High Court of Justice will allow the father a competent sum for maintenance out of the child's estate. A parent may maintain an action for the seduction of a daughter on the ground of loss of her services, if there is evidence of her acting in the capacity of a servant, or living with the parent in such a manner that the parent had a right to her services. A father is entitled to the care and custody of his children, but he may be deprived of the care of them by the Chancery Division of the High Court of Justice, if his conduct is such as, in the opinion of the court, endangers the morals of the children.

A mother who is living apart from her husband may obtain by petition an order from a court of equity for access to her child which is in the sole custody of the father, or of any person by his authority, or of any guardian after the death of the father, subject to such regulations as the judge may think convenient and just; and if such child shall be within the age of seven years, the judge may order the child to be delivered into the custody of the mother until the child attains the age of seven years, subject to such regulations as aforesaid. But no mother is to have the benefit of the Act against whom adultery has been established by judgment in an action at law, or by the sentence of the court.

A child who is under the parental power owes obedience

to his parent, which the parent may enforce by his superior strength, provided he uses it with moderation. He may correct his child in any reasonable manner, but not in such a way as to injure his health. A child is legally bound to maintain his indigent father and grandfather, mother and grandmother, if he is able; the penalty in case of refusal is 20s. per month.

In Scotland nearly similar rules prevail, but it may be of advantage to give a brief *résumé* of the Scotch law. The general rule is *pater est quem nuptiæ demonstrant*, yet this rule has not been so rigorously enforced as in England. In Scotland it is rather a very strong presumption than a rule, and will be overcome by proof of the improbability of the husband being the father of the child—e.g. his absence or impotency. The father is bound to support, clothe, and educate his children according to their rank and station in life. This obligation as to educating seems always to have existed in the law of Scotland, but has been greatly intensified by the Education Act of 1872, which renders primary education compulsory. As regards maintenance it is sufficient that the father receive the child into his own dwelling, unless he behave with undue harshness, in which case the child may be taken from him, and he be compelled to give a due sum for its maintenance. Sons must be maintained till their majority and daughters till their marriage, and this obligation may last during life if from disease, &c., they are unable to maintain themselves, and have no other means of support. The father is the administrator of any separate estate belonging to the child during the minority, unless the donor has otherwise provided. The father is bound to provide for his children not only during his life, but after his death. Thus he cannot by will deprive his children of their right to *LEGITIM*; and where a person leaves heritage the heir succeeding to him must aliment the younger children when they are unable to provide for themselves. A daughter may maintain an action for seduction at her own instance, and therefore the peculiarities of English law in this respect do not exist in the law of Scotland. Children are bound to support their indigent parents or grandparents, but the amount of alimony to be awarded is not determined by any fixed rule: it is intrusted to the discretion of the court, which takes into account the whole circumstances of the case.

The aliment of illegitimate children is a joint burden on both parents. The mother is entitled to custody, and the father is bound to contribute his proportion of the expense. What that amounts to varies, and is very much in the discretion of the court, taking into account the means of the parties, the locality, &c. Formerly it was as low as £1 a year; at present £8 is no uncommon sum. It is contributed quarterly in advance, and is continued until the child can earn its living. In some respects the mother of a bastard child has advantages over the mother of one born in wedlock. The former is entitled to rank for the aliment on the father's bankrupt estate like any other creditor; the latter can make no such claim on her husband's bankruptcy. The paternity of bastards is fixed against the putative father by what is called an action of filiation, generally brought in the sheriff court. While the law refused to allow the examination of the parties to an action, the practice was to consider whether by the evidence of other persons a *semiplena probatio*, or half proof, had been established against the defendant, and if that were so, then reference was had to the oath of the plaintiff, and this, if clear and unequivocal, was held to fix the paternity. Now, however, that both plaintiff and defendant may be made witnesses actions of filiation proceed like other causes, plaintiff and defendant being generally called as the first witnesses. For an exhaustive treatise on this branch of Scotch law see Lord Fraser on "Parent and Child." See also BASTARD, HUSBAND AND WIFE, and INFANT.

PARENTHESIS (Gr., an intercalation or insertion), in grammar, a phrase or clause forming part of a subject or argument, but not immediately connected with it, nor absolutely essential to the meaning. It is usually distinguished by the marks (), or — and —, or by commas preceding and following it. The following couplet of Pope's is a well-known example:—

"Know then this truth (enough for man to know),
Virtue alone is happiness below."

Parentheses are sparingly employed by the best writers, from their tendency to distract the reader's attention, but occasionally they are introduced with admirable effect.

PARHELIA (Gr. *para*, near, *hēlios*, the sun), or Mock Suns, a term applied to the simultaneous appearance of several suns, fantastic images of the true one, which always appear at the same height above the horizon as the orb of day, and are linked together by a circular halo, whose pole is at the zenith, and whose apparent semi-diameter is equal to the sun's distance from the zenith. The mock suns are tinted with the prismatic colours, which are sometimes communicated to the adjacent parts of the halo-circle. See the article HALO and the Plates illustrating it.

PA'RIA, THE GULF OF, extends between the island of Trinidad and the republic of Venezuela in South America, for about 100 miles, from 61° 30' to 63° W. lon. Its south entrance, called the "Serpent's Mouth," is 9 miles across; its north, or the "Dragon's Mouth," is 13 miles in width, and contains several islands.

The gulf itself is one of the most extensive and best natural harbours on the globe. It offers nearly everywhere excellent anchorage. Its depth, except near the shores, varies between 8 and 30 fathoms, and the ground is everywhere free of rocks. It is only along the south-western coast that there are sandy shoals, and these have from 3 to 5 fathoms water on them. The water is as salt as that of the Atlantic, though it receives a great volume of fresh water by those mouths of the Orinoco which fall into it. It is supposed that the current through the gulf is caused by the waters of the Orinoco. The tides also, which rise about 6 feet, run with great force.

PA'RIAS, the name given to the persons of no caste in India. They do not belong to the Hindu race, and from their woolly hair, thick lips, and short stature, some observers consider them to be of African origin. They are regarded with contempt by all classes above them, are only permitted to dwell in the outskirts of the villages, and are expected to perform the meanest public offices. Among themselves they are a hard-working, frugal, and pleasure-loving people, very careless as to their diet, and apparently content with their position. They are very numerous in some parts of India, and in the presidency of Madras they represent about 15 per cent. of the total population. In addition to their common designation of outcasts they have many subdivisions among themselves, some 200 being recognized in the Indian census.

Pariah dogs are the ownerless mongrel curs which are tolerated in the cities of the East on account of their usefulness as scavengers.

PA'RIAN CHRONICLE is the name given to a block of marble preserved at Oxford, which contained in its perfect state a chronological account of the principal events of Greek history during a period of 1318 years, beginning with Kékrops, B.C. 1582, and ending with the archonship of Diognétes, at Athens, B.C. 264. The chronicle of the last ninety years was, however, lost, so that the part which now remains ends at the archonship of Diotimos, B.C. 354. This chronicle was purchased at Smyrna, together with several other relics of antiquity, by William Petty, who was employed by the Earl of Arundel, in the year 1624, for the purpose of making collections of ancient works of art in Greece, Asia Minor, and the islands of the Archi-

pelago. The Chronicle reached London in 1627, and was examined with great care by the learned Selden. "Many of the characters," says Selden, "were entirely obliterated, and many nearly so; nevertheless, by the assistance of glasses, and the critical sagacity of my very kind friend Patrick Young (librarian to the king), after a great many repeated trials, I have restored them as well as I could." The Chronicle was published by Selden, together with other inscriptions which were brought to England by Mr. Petty in the following year (1628), under the title of "*Marmora Arundelliana*."

During the Civil War in the reign of Charles I. the Earl of Arundel removed to Antwerp, and many of the marbles which were deposited in the gardens of Arundel House were defaced and broken, or used to repair the house. The latter was the fate of the Parian Chronicle; the upper part of it, containing at least half the inscription, is said to have been worked up in repairing a chimney at Arundel House; but fortunately a copy of it was preserved in Selden's work. In 1667 Henry Howard, grandson of the Earl of Arundel who obtained the Chronicle from Greece, presented it to the University of Oxford, where it is preserved, together with other antiquities collected by the Earl of Arundel, in the Arundel Museum. The Chronicle was published again in Prideaux's "*Marmora Oxoniensia*" (folio, 1676), which was reprinted in 1732, under the care of Michael Maiffaire, and again in 1791, Oxford, under the care of W. Roberts, and at other times since.

The authenticity of this chronicle was never called in question till the latter end of the last century, in which a work was published by the Rev. J. Robertson under the title of "*The Parian Chronicle, or the Chronicle of the Arundelian Marbles, with a Dissertation concerning its Authenticity*" (London, 1788), in which it was maintained to be a modern fabrication. The arguments of Robertson have been answered by Hewlett and Gough, by Porson in the *Monthly Review*, 1789, by Hales in his "*Chronology*," and by Boeckh in the second volume of his "*Corpus Inscriptionum*."

PA'RIAN MARBLE, a beautiful white marble obtained from the isle of Paros, and used by the Greeks in their finest statuary. See MARBLE.

PA'RIAN PORCELAIN, a very choice description of porcelain, which successfully imitates the more delicate kinds of marble employed in statuary. The ingredients are much the same as for fine English china—viz. ground-flints, calcined bones, china-clay, and potash. It is not, however, used like clay, but in a liquid state, like fluid plaster of Paris. It is poured into a mould, and very carefully baked until it assumes that fineness of texture for which it is distinguished. The mould is then taken to pieces, and the cast liberated. As different moulds are required for the different parts of a figure, considerable care and artistic skill are required to make the respective parts properly harmonize, and produce a perfect *tout ensemble*.

PARING AND BURNING, an operation in agriculture which consists in cutting a thin slice from the surface of land which is overgrown with grass, heath, fern, or any other plants which form a sward by the matting together of their roots. The sods are allowed to dry in the sun to a certain degree, after which they are arranged in heaps, and burnt slowly, without flame or violent heat. The result is a mixture of burnt earth, charred vegetable fibre, and the ashes of that part which is entirely consumed.

The object of this operation is twofold: first, to kill insects and destroy useless or noxious weeds completely; and secondly, to obtain a powerful manure, impregnated with alkaline salts and carbonaceous matter, which experience has shown to be a very powerful promoter of vegetation.

The instruments by which this is effected are, either a

common plough with a very flat share, which may be used when the surface is very level without being encumbered with stones or large roots, as in low moist meadows, or in most other cases a paring-iron used by hand, the cross-bar of which is held with both hands, and the upper parts of the thighs, being protected by two small slips of board, push the instrument into the ground, so as to cut a slice of the required thickness, which is then turned over by moving the cross handle. The labour is severe, and a good workman can scarcely pare more than one-sixth of an acre in a day.

Paring and burning the surface is an almost invariable preliminary in the converting of waste lands to tillage; and where these lands are in a state of nature, overrun with wild plants which cannot be easily brought to decay by simply burying them in the ground, burning is the readiest and most effectual mode of destroying them. In this case the practice is universally recommended and approved of.

But it is not only in the reclaiming of waste lands, and bringing them into cultivation, that paring and burning the surface is practised. The fertility produced by the ashes, which is proved by the luxuriance of the vegetation in the first crop, has induced many to repeat this process so often as materially to exhaust the soil and induce partial sterility. Hence, when used on land already in cultivation, it requires due attention to be paid to the nature of the soil and other circumstances.

If the earth which is burnt with the sods is of a cold clayey nature, the fire will change it into a kind of sand or brick-dust, which is insoluble in water, and corrects the too great tenacity of clays, by converting them more or less into lumps. This is so well known that clay is often dug out of the subsoil to be partially burnt. On stiff clay soils, therefore, there is a double advantage in paring and burning—that of the vegetable ashes and of the burnt clay.

Burning clay soils is something analogous to liming. Lime dissolves the vegetable matter, and enables its elements to enter into new combinations; but if no new vegetable matter be added to restore what is exhausted by vegetation, liming, as well as paring and burning, is detrimental in the end. Many experienced farmers pare and burn the soil on the edges of their ditches and on the banks on which the hedges grow, because they thereby exterminate many rank weeds; and the burnt earth, mixed with farmyard dung, makes an admirable compost. The proper time to pare and burn is evidently after the land has lain in grass for several years, and is broken up for tillage. The surface should be pared thin; about 2 inches is the extreme thickness allowable for the sod if the soil is very stiff and poor, and as thin as possible in a better soil. The sods should be moderately dried, and then arranged into small heaps with a hollow in the middle to hold heath or bushes to kindle the fire. When it has fairly established itself, all the apertures should be carefully closed. Wherever any fire breaks out, a fresh sod should be immediately put over it; a heap containing a small cart-load of sods should be smouldering for several days without going out, even if it rains hard. If the fire is too brisk, the earth will form hard lumps and even vitrify; but otherwise it comes out in the form of a fine powder, in which evident marks of charcoal appear. If this is of a fine red colour, it is a good sign; for the iron in the earth has been converted into a peroxide, which is perfectly innocent in its effects on vegetation, whereas all the saline impregnation of iron are more or less hurtful. It is better to burn the sods in large than in small heaps; for the more the fire is smothered, the better the ashes.

Old rough pastures may often be greatly improved by a very thin paring and burning, so as not to destroy all the roots of the grass. When the ashes are spread over the bare surface, some good grass seeds are sown with them.

The whole is well harrowed or scarified and rolled, and the grass which will spring up after this will be greatly improved, and will fully repay the expense of this simple mode of renovating it. The cost of paring, burning, and spreading is about £1 an acre. On the whole, the operation of paring and burning, when judiciously applied and properly performed, is a most excellent and cheap improvement of dry soils, and it will never diminish their fertility if they are properly cultivated and manured, and a judicious succession of crops is adopted; but, on the contrary, it will improve their quality and texture, and make them more productive.

PARIS, the metropolis of France, and the second city in Europe in point of extent and wealth, is situated on the river Seine, in 48° 50' N. lat., and 2° 20' E. lon. It occupies both banks of the Seine and two islands in the river. In 1860 the *banlieue* or districts immediately outside of the *octroi* limits of 1784 were annexed to the city, and the line of fortifications made the boundary. Paris now covers an area of 30 square miles, with a circumference of over 22 miles. It has sixty-six entrances or gates, and is distant 210 miles in a direct line S.E. of London, or 250 miles by the Dover and Calais route. At the commencement of the sixteenth century the inhabitants numbered only 100,000. About 200 years later that is, in the year 1708—Paris contained 500,000 souls, the population having more than quadrupled within two centuries. Since that period the following has been the progressive increase in the population:—

	Inhabitants.		Inhabitants.
In 1772,	560,000	In 1812, .	1,000,000
1788,	570,000	“ 1851, .	1,053,266
1808,	580,000	“ 1856, .	1,174,316
1816,	622,000	“ 1861, .	1,696,141
1824,	750,000	“ 1866, .	1,823,274
1830,	770,000	“ 1872, .	1,851,792
1836,	900,000	“ 1877, .	1,986,748
In 1881, . . .			2,269,02

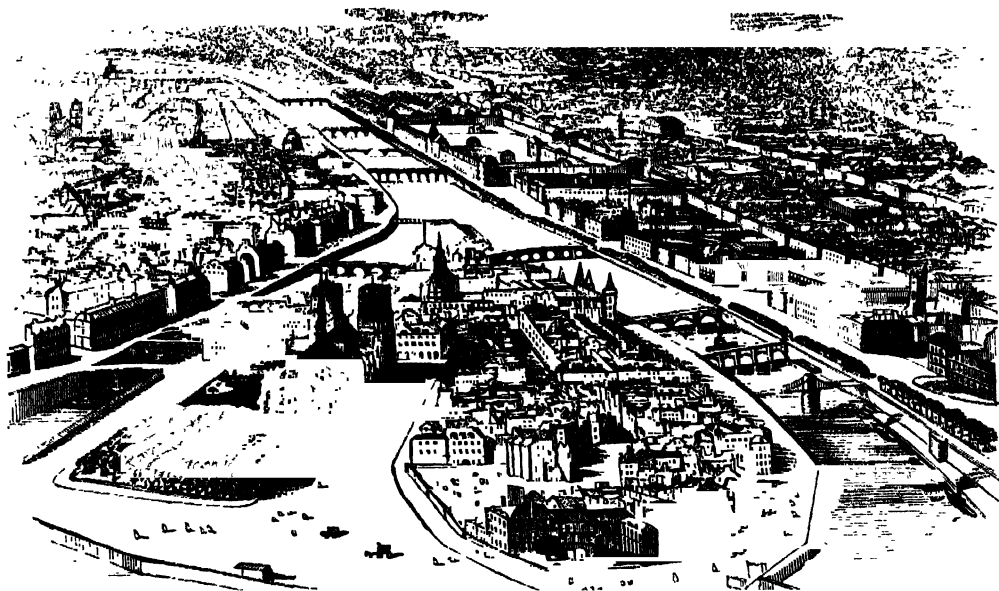
More than one-fourth of the births in the city are illegitimate.

Paris is situated in a valley surrounded by a circle of low hills. The average height of the city itself is about 200 feet above the sea, and none of the hills in the vicinity exceed 500 feet. The mean temperature during the summer is 64° 3', and in the winter, 37° 8' Fahr. The average number of rainy days is 105 every year; those on which snowstorms occur, twelve. Like London, Paris is divided into two unequal portions by the river, the larger and more important division being on the north. The modern fashionable quarter, and that in which most of the hotels, shops, &c., are situated, is north-west of the Tuileries, and comprehends the Rue de Rivoli, Place Vendôme, Boulevard des Italiens, and Champs Elysées. In the Faubourg St. Germain, on the opposite side of the river, are to be found the hôtels or city residences of the nobility, still inhabited by the aristocracy, who keep up the traditions of the old French society, and most of the ministries and government offices. There is nothing in Paris like “the city” in London. The Bourse, or Stock Exchange, is close to the commercial quarter, and not far from the Bank of France; but most of the establishments of the wholesale dealers are at some distance, chiefly in the neighbourhood of the Rue Poissonnière and the Boulevard de Sebastopol.

In the east quarter of the city, or Faubourg St. Antoine, are numerous manufactories and the dwellings of those who work in them. On the Ile de la Cité are the law courts, central police office, and cathedral; and on the south side of the river the Faubourg St. Germain and Quartier Latin, formerly the students' quarter. On the outskirts, as in the Faubourg St. Victor, is to be found the poorest and most wretched part of the population.

For municipal purposes the city is divided into twenty *arrondissements*, each of which has a mayor, a *juge de paix*, and a commissary of police, and over all are placed the prefect of police and the prefect of the Seine. The latter is the head of the municipality, and discharges duties similar to those of the lord mayor of London, in addition to those which belong to lords-lieutenant of counties in England. Assisted by a council, appointed, as he is himself, by the government, he controls all building operations, excise duties, markets, hospitals, charities, public fêtes, cabes, &c., not only within the city but the whole department of the Seine. The great importance of this office may be gathered from the fact that the prefect is practi-

cally a minister of state, administering, as regards the city alone, the affairs of a population of more than 2,000,000. The duties of the police are construed somewhat widely in France, and include the superintendence of suspected persons as well as the detection and punishment of actual offenders, the maintenance of public health and comfort as well as of order and security. It is estimated that between 50,000 and 60,000 members of the criminal class haunt Paris and require to be looked after. The police are further charged with the regulation of certain trades, and have also a control over public nuisances of all descriptions. The prefect is head of the council of health, which has charge of the cleansing, sewerage, and water supply of



Bird's-eye View of Paris from over La Cité.

Paris. A numerous body of scavengers are employed in keeping the streets clean. Some of the main thoroughfares are efficiently swept several times a day, but the more secluded passages are too often neglected.

The municipal council is composed of eighty members, elected by as many separate *quartiers*, for a period of three years. Every citizen being twenty-one years of age, having resided for a twelvemonth in the city, and having never been sentenced to penal servitude (*travaux forcés*), may vote at municipal elections, and any Frenchman, whether by birth or naturalization, who has completed his twenty-fifth year is eligible for election. The councillors are not paid; they meet two or three times a week during ten months of the year, and on the days when there is no

sitting are engaged on the various committees and sub-committees, which have business enough to engross almost all their time and energies. An idea of the extent of this business may be gathered from the fact that the matters under the control of the standing committees are classed under sixty-five heads. They include all the affairs which in London are dealt with by the City Corporation, the Metropolitan Board of Works, the Chief Commissioner of Works, the School Board, and the vestries, with sundry other affairs which in England are left to private management. Thus in Paris, the General Funeral Company, the cemeteries, the pawn offices (*monts de piété*), the markets, hospitals, and asylums, the museums and public libraries, the kiosks where newspapers are sold, and several of the

theatres, are municipal institutions, and must be managed by the Town Council, although that body cannot introduce changes in any one of them without the approval of the Home Office, given through the Prefect of the Seine.

Every three months the council elects its president, who is merely a chairman of debates. The prefect attends all the sittings of the council, and he may take part in the debates and bring forward motions or amendments, but without voting. The budget of the entire city amounts to nearly £10,000,000 sterling, the receipts being drawn from rates, the octroi or municipal customs, which yield 143,000,000 francs; the market dues, 7,000,000; the gas monopoly, 18,000,000, &c. The principal heads of expenditure are:—Schools, 24,000,000 francs; public charities, 19,000,000; street paving, 20,000,000; water and drainage, 13,000,000; and then there is the large interest on the city's debt. All these are called "compulsory expenses," and must be provided for according to the estimates framed by the municipal executive. It is a curious arrangement, for in theory the Prefect of the Seine cannot touch a franc of the city's money without the vote of the council, and yet, if the vote of a compulsory item were refused, the government would take no account of the refusal, and any protest which the council might formulate would be illegal, because all the edicts of that body must be countersigned by the Prefect of the Seine before they can be entered on the minutes.

Probably no city in the world has ever witnessed such gigantic improvements as Paris under the Emperor Napoleon III. Dense masses of houses and numerous tortuous streets were replaced by palatial edifices, broad boulevards, and spacious squares. Public works of colossal magnitude were undertaken, whilst those commenced in former reigns were brought to a successful completion. Embellishments on the most extensive scale were effected in the public parks and gardens; and what is of incalculable importance, the city was thoroughly well drained and well supplied with water. Most of the buildings are of a light-coloured kind of limestone, easily wrought and carved ornamentally. The stone is chiefly excavated on the south side of the city, which has become quite undermined in consequence. The dwelling-houses are generally built in large blocks six or seven storeys high. Each floor constitutes a separate dwelling, and access to all is gained by a common staircase, which is usually placed under the charge of a porter at the entrance. Very frequently the houses surround an open quadrangle, as in the case of the model lodging-houses erected in London. Notwithstanding all that has been done, the evils of overcrowding are even more pressing than in London; whilst Paris is decidedly deficient in recreation grounds. There are now very few private gardens left. There are three parks within the city—those of Monceau, Montsouris, and Chaumont; but the last named, which is the largest, does not exceed 62 acres, and the three together only measure 130 acres. The public gardens of the Tuileries, Palais Royal, Luxembourg, the Esplanade of the Invalides, and eight small squares complete the breathing spaces of the city, occupying in the aggregate less ground than the St. James's and Green Parks, though to them must be added the Avenue des Champs Elysées, which, if it does not offer the same resources for recreation as a London park, is a favourite walk. Almost all the parks and gardens of Paris are mere walks, and if the Parisian wants a place where he can run or stretch himself on the grass he must go to the Bois de Boulogne or that of Vincennes, the one 4 miles and the other 5 from the centre of the city.

The most important of the public buildings is the Louvre, a grand pile inclosing a large square court on the right bank of the Seine, between it and the Rue de Rivoli. It was formerly a hunting seat of the early French kings, and its name is supposed to be derived from the wolves

(*loups*) which then swarmed around it. About 660 years ago Philip Augustus converted it into a feudal fortress. It was afterwards used as a state prison. The present edifice was commenced by Francis I., and continued by Henry II. and Cathérine de Médicis. Henry IV. began the long gallery to connect it with the Tuileries, and under Louis XIV. the eastern and southern façades were built; they are deemed the finest portions of the palace, the east front containing a magnificent colonnade of twenty-eight twin Corinthian columns. It was intended to complete the whole building in an equally beautiful manner, but the Grand Monarque, in a fit of caprice, suddenly transferred all his funds and energy to the erection of Versailles, and a considerable portion of the Louvre remained unroofed till 1802. The building was much improved by Napoleon I. Louis XV. was the last sovereign who made the Louvre his residence. The building is now used as a national museum. The idea of so converting it was first conceived by Napoleon I. in 1796, and he collected in it not only all the art treasures of France, but spoils from the principal galleries of Europe, the trophies of his early victorious campaigns. Many of these were, however, restored to their original owners at the peace of 1815. Not fewer than fifteen different museums are now congregated in the Louvre:—(1) The Museum of Painting; (2) Ancient Sculpture; (3) Middle Age and Renaissance Sculpture; (4) Modern Sculpture; (5) Drawings; (6) Engravings; (7) Naval Science; (8) Relics of the Sovereigns of France; (9) Assyrian Antiquities; (10) Egyptian Antiquities; (11) Greek and Etruscan Antiquities; (12) Ethnographical Collection; (13) Algerian Curiosities; (14) The Museum of Napoleon III.; (15) The Sauvageot Collection. The enormous collection of works of art occupies nearly the whole of the buildings forming the Louvre Palace and the Louvre Gallery. As a whole it is perhaps the finest, and as regards numbers, the largest in Europe; although in separate departments it must yield to smaller collections in other European capitals. Most of the objects are set out and exhibited to the best advantage in splendid rooms. The building formerly contained a large library, but this was burnt by the Communists in 1871.

The palace of the Luxembourg, at the extremity of the Rue de Tournon, in the Faubourg St. Germain, was commenced in 1615 by Marie de Médicis, then regent, in the style of the palaces of her native city, Florence. The imitation is, however, defective. The palace consists of a centre and a couple of wings connected by terraced arcades, and takes its name from the mansion of the Duke of Piney-Luxembourg. The gardens of the Luxembourg are tastefully laid out, and adorned with statues of the illustrious women of France.

Many of the other government buildings are situated near the Quai d'Orsay, including the Foreign Office, a profusely-sculptured building in the Greek style. The War Office is at the corner of the Rue de l'Université; the Ministry of Public Works in the Rue St. Dominique; the Home Office and the Ministry of Education and Religion in the Rue de Grenelle—all parallel streets. The Hotel de Ville, near Notre Dame, was burnt by the Communists in 1871, but was rebuilt in 1878–80, and is an exceedingly handsome structure.

Including the Conciergerie, there are eight prisons in Paris. The most important is La Force, on the Boulevard Mazas. The prisoners are here confined on the solitary system in six wings, which radiate, like the spokes of a wheel, from a central tower, the warders in which can see what is passing in the corridors on every side. There are three storeys of cells in each flat, 1260 in all. This prison receives only persons who are awaiting trial. The Maison Centrale d'Education Correctionnelle, in the Rue de la Roquette, is a juvenile reformatory, also on the solitary system, and consists of eight wings converging to a centre.

The inmates are taught reading, writing, and certain trades, such as tailoring, shoemaking, carving, &c., but are compelled to study and to work alone. Opposite this prison is the *Nouveau Bicêtre*, which receives convicts sentenced to death or penal servitude. The guillotine, when required for an execution, is erected in the street between the two last-named prisons. The jail of *Ste. Pélagie* is assigned to political offenders and persons sentenced to brief terms of imprisonment. In the *Conciergerie* are lodged prisoners who are on trial. The *St. Lazare* is a prison for women, the *Madelonnettes* for juvenile criminals, and the *Clichy* for debtors. There is also a military prison in the *Rue du Cherche Midi*. In most of the Paris prisons the inmates are either compelled or are at liberty to work at a trade; and their earnings, which amount in all to about £10,000 a year, are divided between them and the administration.

The *École Militaire*, on the south of the *Champ de Mars*, is one of the chief barracks in Paris, and has accommodation for 10,000 men and 800 horses. The *Hôtel des Invalides* was founded by Louis XIV. in 1670. The façade is 612 feet in length, and is profusely adorned with military emblems. The building occupies an area of 16 acres, and includes about eighteen different courts. It can accommodate 5000 invalids or veterans. In different parts of the building are trophies of the French army, consisting of flags, cannon, &c., captured from other nations. Most of the flags are in the chapel, which is a very handsome structure, and in which military mass is performed every Sunday. The most interesting portion of the building is the tomb of Napoleon. Beneath the dome a circular marble balustrade surmounts a depression 19 feet deep, in the centre of which stands the sarcophagus. The effect of this is very good, and the entrance to the tomb is exceedingly fine and grand. The walls of the crypt are of polished granite. Round the bottom of it runs a covered gallery, adorned with bas-reliefs and supported by twelve colossal figures. On the walls are inscribed the names of Napoleon's chief victories. The sarcophagus is formed out of an immense monolith of reddish-brown granite, weighing 135,000 lbs., which was brought from Lake Onega, in Finland.

The *Place de la Concorde* is without doubt one of the grandest and most imposing open spaces in any city in the world, and is the culminating point in the splendour of Paris. It connects the gardens of the *Tuileries* with the *Champs Elysées*. From the centre a magnificent view is obtained. The place is splendidly decorated. Thrones supporting typical figures of the chief cities of the empire encircle it. In the centre is the famous obelisk of Luxor, which was brought from Egypt and erected here in 1836 at a cost of £80,000. It is 73 feet high, and covered with hieroglyphic inscriptions.

The *Champs Elysées* (*Elysian Fields*) are handsome promenade grounds, extending from the *Place de la Concorde* to the *Arc de Triomphe de l'Étoile*. In length they exceed $1\frac{1}{2}$ mile, and cover an area of about 295,000 square yards. They are intersected by a broad avenue, called *Avenue des Champs Elysées*, in the middle of which is the *Rond-Point*, a circular opening from which several roads branch off. From the avenue can be obtained one of the finest views in Paris. The *Arc de Triomphe de l'Étoile*, at the top of the *Champs Elysées*, was commenced by Napoleon in 1806; but the works proceeded slowly, and in 1815 were suspended altogether. They were resumed in 1823, and finally accomplished in 1836, about £418,000 having been spent on them. The total height of the monument is 152 feet, the breadth 187 feet, and depth 68 feet. The central arch is 90 feet by 45 feet, and is supposed to be the largest in the world, the arch of Augustus at Rimini being the next to it in size. The piers of the arch, facing the *Champs Elysées*, are adorned with two

imposing alto-reliefs, the one representing the Departure in 1792, and the other the Triumph of 1810. The bas-reliefs on the other side represent the resistance of France to the allies in 1814, and the peace of the following year. The battles of Austerlitz, Aboukir, Alexandria, &c., are portrayed in smaller alto-reliefs in other parts of the arch, which has altogether a most imposing effect, although by no means free from architectural vices. The Palace of the *Trocadéro*, a building erected for the exhibition of 1878, contains a vast music-hall, capable of holding 15,000 people.

The *Jardin des Plantes* is not, as its name would imply, merely a botanical garden, but a comprehensive museum of natural history. The origin of this establishment dates from the reign of Louis XIII. Originally a royal herb-garden, it became after a time the seat of a school of botany. Having received gifts of mineral, anatomical, and other collections, the gardens gradually acquired the character of a museum. It is, however, to Buffon, who assumed the directorship in 1739, that it mainly owes its treasures and celebrity. Of late years several new chairs have been founded, so as to form a complete university of natural history, and the number of plants, trees, animals, &c., has been greatly increased. The collection of wild animals is one of the largest in Europe.

The Garden of the *Acclimatization Society*, founded in 1858, and opened in 1860, occupies an area of about 45½ acres in the western part of the *Bois de Boulogne*, near the village of Neuilly. It was established in order to carry out the experiments of the *Imperial Society of Acclimatization* in naturalizing and propagating foreign trees, plants, and animals. Among the most important results obtained by the society, may be mentioned the introduction of several new breeds of silkworms, llamas, alpacas, yaks, goats from Egypt, Senegal, and Angora, sheep from China and other countries, and a large variety of fowl and game.

There are scattered throughout Paris a number of public gardens, for which the English title of squares has been imported. These have been formed by the municipality in quarters in which dense masses of population threatened to render the atmosphere heavy, and which were too distant from the *Tuileries* and *Champs Elysées* for the inhabitants to reach those places easily. Trees have been planted with a hygienic object, and hence those of a special kind, and very absorbent, have been selected. Fountains also have been erected.

The *Boulevards of Paris*, of which there are more than twenty, present most striking features. They are in reality handsome and spacious streets, lined with trees and seats in all the better parts of the city. They owe their origin to the improvements that took place in Paris under Louis XIV., when the ancient fortifications of the city were destroyed and the ditches filled up. The king determined to form a wide road on the northern ramparts and plant it with trees, and in 1670 this, the first boulevard, or bulwark, was opened for public use. A complete circle of boulevards now surrounds the city on all sides, but they were not thoroughly completed until the reign of the late emperor.

There are twenty-seven bridges over the *Seine*, eight of which have been constructed since 1852, and several of the old ones repaired and even rebuilt. The most ancient are the *Pont Notre Dame*, erected in 1500, and *Pont Neuf*, begun in 1578, completed in 1601, and thoroughly renovated in 1852. Among the others may be named the *Pont de la Concorde*, *Pont du Carrousel*, and *Pont de Solférino*.

On each bank of the *Seine* extends a range of spacious quays, which, being planted almost throughout with trees, and commanding interesting views of the city, form a very agreeable promenade. To Napoleon I. is mainly due the conception of the present magnificent work, which, commenced under the first empire, was completed under

the second. There are now 12 miles of quays. The embankment of the Seine is of the most solid and perfect character, and has cost immense sums of money, especially of late years.

Wharves and landing-places are formed in different parts, particularly towards the east end of the city. Depots for firewood are to be found along the river, and on all the outskirts of the town. The navigation of the Seine is effected by large boats, called *coches d'eau*, by bargues, and by steamers, the number of which is fast increasing. From the higher parts of the river about 11,000 boats arrive every year with fruit, corn, and flour, hay, wine, paving stones and bricks, besides about 4000 bargues laden with timber, charcoal, and firewood. Barges of from 40 to 60 tons burden come from Rouen with colonial produce, cotton goods, cider, salt, and foreign corn; steamers also ply daily between the two cities, and in the summer between Paris and Montreuil.

The theatres are among the chief attractions of Paris: nowhere are operas and ballets produced with greater splendour or perfection. Sunday is the most crowded night of the week at all places of entertainment in Paris. The New Opera-house, which was opened in 1875, is the principal theatre, and is distinguished for the splendour of its scenery and ballet. It is an exceedingly handsome building, and accommodates more than 3000 spectators. Next in importance to the opera is the Théâtre Français, which is the seat of the French regular drama, tragedy, and comedy. It is a handsome building externally, and has accommodation for 1500 persons. It receives about £10,000 a year subsidy from the government. The Opéra Comique is devoted to light operas; annual subsidy, £9600. The Odéon, although, as its name implies, originally destined solely for music, is open for tragedy, comedy, and other dramatic performances, and may be regarded as a minor Théâtre Français. It holds 1600 persons. At the Théâtre des Italiens the best Italian music may be heard. The audience is usually select. The season is from November to April, when many of the singers repair to the opera in London. There are a large number of other theatres of less importance, and not requiring special notice here. Besides its theatres, Paris has continually a large number of excellent concerts, and there are few cities in the world where the dance has so great a number of votaries; but few of the public balls are frequented by respectable company.

The restaurants, or dining houses, are frequented by all classes of the inhabitants, female as well as male. It is an admitted fact, however it may be accounted for—whether it arose from advantage in an economical point of view, in the taste of the people for society, or whatever else—that home, in the English sense of the word, has but few charms for the bulk of the Parisians, a people who may be said to live in public, dining in restaurants, spending their evenings on the boulevards or in the theatres or cafés, and on the whole seeming to prefer an out-door to an in-door life.

Paris contains upwards of sixty parish churches. The principal ones are the Cathedral of Notre Dame, the Church of Ste. Gèneviève or the Panthéon, the Madeleine, and the Sainte Chapelle. The Cathedral of Notre Dame is 442 feet in length externally; in breadth, 162; breadth of nave, 42; length of nave to transept, 186; transept, 155; width of front, 134; and height of towers, 235 feet. The plan is divided into a nave and four aisles, besides a range of seven chapels on each side between the external buttresses; consequently the projection of the transept, or form of the cross, does not show itself at all in the lower part of the building. The exterior, though not without beauty, is heavy, owing to the absence of steeples and pinnacles, which give a light appearance to the majority of Gothic buildings. The west front, however, with its three large

gates and circular window, and the noble gateway on the west side of the church, are highly worthy of admiration. In magnitude, and in the richness of plan produced by the additional aisles and chapels, Notre Dame is superior to Westminster Abbey. It was erected between 1010 and 1407, and has recently been tastefully and conscientiously restored. It is generally considered one of the finest examples extant of Gothic architecture—almost every phase of which is here illustrated in succession. A diabolical attempt to burn it by the Communists in 1871 was fortunately frustrated, and the building escaped with very slight damage.

The Church of Ste. Gèneviève, or the Panthéon, secularized in 1885, attracts notice chiefly on account of the dome with which it is surmounted. The interior is 295 feet long; transept, 262; and breadth, 101. The highest point of the dome is 268 feet from the pavement. The portico is composed of twenty-two fluted Corinthian columns, 60 feet in height, supporting a triangular pediment 120 feet broad and 24 feet high, in which is a sculptured composition representing the genius of France (a colossal figure, 14 feet high), surrounded by the great men of the nation. The plan of the building is a Greek or equilateral cross. The inside is empty, without any embellishments, except its architectural decorations, but enriched with statues of Voltaire, Rousseau, Lagrange, and other illustrious individuals, whose remains have been deposited in the spacious vaults beneath the pavement, and beside whom Victor Hugo was laid in 1885.

The Church of the Madeleine is on the model of the Parthenon of Athens, upon a larger scale, and is a very fine piece of classical architecture. The dimensions are 328 feet by 138, independently of the projection of the flights of steps at each end, which make the total length of the base or sub-structure 438 feet; the columns, fifty-two in number, are 62 feet high, and the entire height from the ground to the apex of the pediment, 116 feet. The interior measures 259 feet by 52, and consists of three compartments in length, covered by as many flat domes, through which the building is lighted, there being no side windows. It is altogether a very noble structure, and is remarkable for purity and excellence of design. Both Ste. Gèneviève and the Madeleine were slightly injured during the reign of the Communists in 1871.

The Sainte Chapelle is one of the wonders of Paris. It was built in 1245–48 by St. Louis, for the reception of the crown of thorns and other reputed relics of the Saviour. The most remarkable feature of the exterior is the golden spire, 114 feet high from the ridge of the roof to the weather-cock—the ornamentation of which is almost as fine and elaborate as that of a piece of jewelry. The interior is divided into two parts—an upper and a lower chapel. A spiral staircase in one of the towers leads to the upper chapel, upon entering which the eye is dazzled with the profusion and brilliancy of the decoration. The azure ceiling is thickly studded with stars, and the walls, which are of the same hue, are embellished with golden *fleurs de lis*. The windows are filled with magnificent painted glass of the thirteenth and fifteenth centuries, the gaps in which have been recently cleverly restored. Each window presents a series of subjects, one as many as 121, all taken from the Bible, with the exception of a single window, which portrays various incidents in the life of St. Louis. None of the other churches in Paris are of sufficient importance to require special notice.

University of Paris.—The kernel of the University of Paris is the famous College of the Sorbonne, founded in 1253 by Robert de Sorbonne, and formally approved by Pope Clement IV. in 1268. Later on this great foundation practically absorbed the university, and large new buildings were constructed under the auspices of that munificent patron of literature, Cardinal Richelieu, who

opened them with much ceremony in 1629. The church, so well known to visitors to Paris, was built a little after (1635-59). It should be added that the fine library of the Sorbonne was burnt by the Communists in 1871. But the College of the Sorbonne, one of the first of the corporations called colleges, was the product, not the cause, of the old University of Paris. The faculty of arts is at least as old as 1169. Paris was the most famous of all the great centres of the "schoolmen," and especially devoted itself in the thirteenth century to theology, while rivalling Bologna with law and Salerno with medicine. By the beginning of that century the University of Paris had acquired almost independence. It refused admittance to the police of the Mayor of Paris, as well as to the officials of the bishop, and the king's messengers could only with difficulty enter its precincts. It had numerous privileges, its own laws, and elected and appointed its own magistrates. Repeatedly the university and the city or the church came into open conflict. In 1228, for example, fighting went on for some days; and when two scholars were killed, and the satisfaction demanded of the city for their death was refused, the university closed its gates and suspended its work. Finally, as the city still held out, many teachers and students left for other universities. The church fell upon its ancient foe and seized the well paid posts. When the anger of the professors was over, and they began to drift back to Paris, they found Dominican monks teaching from their chairs. It needed the Pope's own interference to pacify the offended teachers and to drive out the intruders.

The Dominicans and Franciscans, so opposed in all else, were united against the great university; but in some senses the university was greater than they, and its fame long continued. One of the best of our own chroniclers is called Matthew of Paris, because he had studied at what was then the great source of learning. Towards the close of the thirteenth century, Pope Nicholas I. granted to the graduates of the University of Paris the power to teach everywhere, other graduates being only able to teach within the limits of their own university; and this universal degree, while raising Paris to the head of learning, served the very useful purpose of binding men of culture into one large community widely spread. All this ancient organization disappeared in the whirlpool of the French Revolution.

The university was merged by Napoleon I. in the "University of France," which centralizes all the higher education of the country at Paris: and the governing body of which is now the Council of Public Instruction, presided over by the Minister of Public Instruction. This body controls all educational institutions in France, from elementary schools to colleges; and has under it twenty-seven academies, each with a certain territory allotted to it, which serve in some sort the functions of small local universities.

The headquarters of the University of Paris are still established at the Sorbonne, where degrees are granted in the faculties of sciences, letters, and theology, and where gratuitous lectures on subjects comprised within those faculties are delivered. The college occupies an area of nearly 3 acres. The library contains 100,000 volumes. There is a large amphitheatre, capable of accommodating nearly 2000. The faculty of law is domiciled at the *École de Droit* (school of law), Place du Panthéon. Four years and a number of severe examinations have to be passed in order to obtain the degree of doctor of law; three years are sufficient for a licentiate. There are twenty-five professors, and usually about 1500 students. The *École de Médecine* (school of medicine) governs the faculty in that science, and is the resort of students from all parts of the world, attracted partly by its high reputation, and partly, no doubt, by its cheapness. The professors number fifty, and the students number about 3000. All the lectures are gratuitous, and the fees for certificates and diplomas

are comparatively trifling. The conditions, however, on which a degree is granted are stringent, and the preliminary examinations very searching.

At the National College lectures are delivered by twenty-nine professors, on languages, literature, and the sciences, all gratuitous. There are several lycées, or schools, where pupils receive an education preparatory to the studies at higher colleges, supported by the government, and also municipal colleges, affording a sound mercantile education for a small remuneration, and specially intended for the children of operatives. Elementary instruction is well provided for. There are also several special schools, such as the *École Polytechnique*, where all the branches of military science are taught. As in most of the other public, and also in many of the private seminaries of Paris, the pupils in this school wear a uniform. The Institute of France is fully described in the article *INSTITUTE NATIONAL*.

The Paris Observatory is situated at the end of the Boulevard St. Michel, near the Luxembourg. It was built in the year 1667, and is conspicuous by its two towers, one of which is covered by a copper cupola. The observatory contains a magnificent collection of telescopes and other astronomical instruments, together with an anemometer for recording the direction of the wind, and a pluviometer for measuring the rain. The theatre is capable of holding 800 persons, and there are 45,000 volumes in the library. The Bureau des Longitudes, which issues an annual publication answering to the English *Nautical Almanac*, and under the auspices of which Arago delivered his celebrated lectures, holds its meetings in the observatory.

The hospitals of Paris are under the direction of a council of high officers, designated the *Direction de l'Assistance Publique*. In addition to endowments and voluntary contributions for their support, the charities of Paris are assisted by a tax of 8 per cent. on the sums received at the theatres and other places of amusement, a tax on the cemeteries, a portion of the *octroi* of the city, and the profit from the Mont de Piété. There are sixteen hospitals, containing 7052 beds, and eleven hospices or establishments for the support of aged, infirm, blind, deaf, or insane persons, to the number of 10,143; there are also some smaller establishments founded by private benefactors. There are, for the exclusive use of the hospitals and hospices, general bakehouses, cellars, slaughter-houses, and a general pharmacy. In every arrondissement there is a dispensary for out-patients under the same board as the hospitals. Of the public hospitals the *Hôtel Dieu* is entitled to special notice on account of its antiquity; for it is known to have existed in the twelfth century, and even at that early period to have had some valuable endowments. Since the Revolution of 1793 the building has been much enlarged and improved, and with a subordinate establishment belonging to it in another part of the city, it now has 850 beds. The average number of patients is 12,000 per annum. It is in every respect well appointed, and has among its medical officers the most celebrated physicians and surgeons of Paris, so that it may be considered the great normal hospital in France. The largest of the asylums for the infirm and aged are the *Salpêtrière* and *Bicêtre*, in each of which is a department for inmates of both sexes. The former has accommodation for 4500 inmates, of whom 1500 are insane. With but two or three exceptions the French hospitals are situated in close neighbourhoods, and from the antiquity of the buildings ill-planned; but the interior management is extremely good, and may bear comparison with that of the first London hospitals. A peculiarity of the Parisian charities is the *crèches*, or public nurseries, first established in 1844. There are now eighteen in different parts of the city, and in them poor women are allowed to leave their infants while they go out to work. The charge is 2*d.* a day. The mother must come and feed the child at stated intervals.

The Mont de Piété, the government pawnbroking establishment, is included in the official enumeration of the charities of Paris, because its profits are devoted to charitable purposes. It has twenty-five offices in Paris. Savings banks, friendly societies, and the like, are not so numerous in Paris as in London.

Paris is the great centre from which emanate all the important publications of France, and in which congregate all the most distinguished French writers. The increase of publications appears to have been regularly progressive since 1817. Within the last twenty years a vast number of important and valuable new works, especially in history, philosophy, and science, have issued from the French press, as well as the republication of many old standard books. The largest of these undertakings are generally conducted at the expense and risk, not of one, but of several publishers, on a joint-stock principle.

The Hôtel des Monnaies is a vast building, including eight courts. It comprises the laboratory, workshops, and machinery of the mint, and a museum, containing an interesting collection of coins and medals of all countries, in copper, silver, and gold. The French medals are admirable for their high relief and sharp and finished execution. The coining machines are very ingenious, and when all are working produce coin to the value of £1,500,000 sterling a day. In addition to this, coins and medals are struck in Paris in considerable quantities for other countries. In part of the mint are extensive laboratories for the government assays, and those of all the jewelry and plate manufactured in Paris, the same as at the Goldsmiths' Hall in London.

The Paris Exchange or Bourse was commenced in 1808. It stands in the middle of a square—the Place de la Bourse—is in the classical style, and consists of a parallelogram, measuring 164 feet by 234, surrounded by a Corinthian peristyle of sixty-four columns, each 40 feet high. Its erection occupied eighteen years, and cost £325,000. The large hall in which the brokers and merchants transact business is 120 feet by 80 feet, and can accommodate 2000 persons. It is paved with marble, and surrounded by arcades of that material. No legal transaction with regard to stocks can take place beyond the limits of the bourse, or without the intervention of an official agent.

The Bank of France is near the Bourse. It has a grand monumental entrance, and displays on its walls several emblematic bas-reliefs. The capital of the bank is between £4,000,000 and £5,000,000 sterling, and it enjoys the monopoly of issuing bank-notes. The cellars contain immense quantities of bullion, and are approached by a long winding staircase, so narrow that only one person can ascend or descend at a time. In order to lend additional security to these precious stores, it is said that arrangements exist by which the cellars could be at once inundated with water or filled with noxious vapours, so as to render them inaccessible in case of an attack by insurgents or foreign invaders.

The Tribunal of Commerce is situated in a magnificent hotel, opposite the Palais de Justice. The judges of this court are selected from the leading merchants of the capital, and its jurisdiction extends over all cases of bankruptcy, mercantile differences, &c. The Conseil des Prud'hommes (Council of Arbitrators or Prudent Men) meets at 18 Rue de la Douane. There are about a hundred of these tribunals in France; and so successful are they in preventing litigation, that out of the 4000 cases which, on the average, annually come before them, 3880 are settled amicably. Two-thirds of the cases relate to questions of wages. Each council is composed in equal numbers of masters and men, chosen by the classes whom they respectively represent. The members serve gratuitously.

There are about twenty *halles* or covered markets, and thirty *marchés* or open-air markets in Paris. The Halles

Centrales is the most important. It is an immense and magnificent establishment, with a roof of iron and glass. Fish, poultry, meat, vegetables, fruit and flowers, butter, cheese, and eggs, have each a certain space assigned to them. It is much more the custom to purchase by retail in the markets of Paris than in London.

On all articles of provisions brought into Paris an OCTROI or city duty is levied. The sum derived in this way is now nearly £6,000,000 per annum, having considerably more than doubled in twenty years. The annual amount of local taxation for the inhabitants of Paris is about £4 10s. each.

There is a comparatively large manufacturing population in Paris; for, besides being the political capital of France, it is one of the chief seats of the national industry and commerce. Many branches of trade are conducted on a large scale; the advantages resulting from the greater subdivision of employment, and the command of scientific assistance and skilled workmen, being more than sufficient to counterbalance the higher wages and heavier expenses in other respects attending their prosecution in so great a city. But it will always be impossible for a city like Paris, without coal and without the command of water power, to compete successfully with such places as Manchester, Glasgow, and Birmingham. The articles produced are, in fact, chiefly those of *vertu*, jewelry, the fine arts, or those immediately ministering to the luxurious wants of a great capital. Two large manufacturing establishments belong to the government, and are carried on at loss. One of these is the celebrated Gobelin's Tapestry Manufactory, which has been in the hands of the government for more than two centuries. The pieces of tapestry are most exquisitely executed, and the effect of some of them is scarcely inferior to the finest oil paintings. The manufacture of a single piece frequently occupies three or four years, costing from 15,000 to 18,000 francs. Some splendid carpets are likewise made in this establishment. Its products are chiefly destined for the palaces and public buildings, or for presents to monarchs and distinguished personages; a few of the inferior pieces of tapestry are allowed to be sold, but the sale of carpets is forbidden. A school for teaching drawing is attached, and lectures are annually delivered by the most celebrated chemists on the chemical principles of dyeing. The national manufactory of tobacco is conducted on a very extensive scale, in a handsome and modern structure on the Quai des Invalides. About a fifth of the entire produce of tobacco in France is made at this establishment. The manufactory of the celebrated Sèvres porcelain is about 6 miles from Paris, but is generally enumerated among the industrial establishments of the city. Some of the articles produced here yield very high prices, and are esteemed alike for their elegance of form and the beauty and brilliancy of the paintings. Among the other manufactures of Paris are Cashmere, silk, and woollen shawls; light woollens, cotton goods, hosiery, gloves, hats, embroidery, lace, and other articles of fashionable attire; jewelry, gold and silver plate and trinkets, clocks and watches, bronzes, and musical, mathematical, and philosophical instruments; paper-hangings, household furniture, carriages, saddlery, leather, glue, cutlery, fire-arms, liqueurs, and confectionery. Dyeing, printing, engraving, and lithography; the manufacture of salts, acids, oxides, and other chemicals; the refining of sugar, tallow-melting, the distillation of brandy from potatoes, brewing, and the manufacture of potato-starch, are carried on with considerable activity. There are numerous large factories, but many of the manufactures are conducted in private houses by workmen, aided by their families or apprentices. The quantity of timber brought into Paris is immense, as wood is the principal fuel, but the consumption of coal is rapidly increasing.

There are eight railways terminating in Paris, and also a line encircling the city and connecting the different

lines with each other. The Seine furnishes the principal means of water-carriage; it is navigable for barges and other small craft. The canals of the Ourcq, St. Denis, and St. Martin, give to Paris water communication with many parts of the vicinity.

The omnibus system of Paris is in the hands of a single company. Each omnibus at certain points crosses the routes of other omnibuses, and any passenger can by means of a *billet de correspondance* exchange from one to another. The cabs or *fiacres* number altogether about 20,000, of which more than 2000 are daily in use, distributed over between seventy and eighty different stands. The vehicles are hardly equal to those of London of the same class.

The water supply of Paris is derived from the Canal de l'Ourcq, and the Aqueduct of Arcueil, by gravitation; from the Seine by steam-pumps; from the artesian wells of Grenelle and Passy, and from some minor sources to the north of the city. The greater part of the supply is devoted to the fountains, and to trade and public purposes. There are not fewer than fifty public and thirty monumental fountains in Paris. The well of Grenelle is on the artesian system, and derives its supply of water from the green-sands beneath Paris, at a depth of nearly 600 yards. The success of this experiment, which was made in 1841, led to the sinking of other artesian wells at Passy, opened in 1861, and carried 130 feet deeper than that at Grenelle, and at La Chapelle and Buttes-aux-Cailles.

The drainage of Paris has been effected on a magnificent scale. There are six main galleries called collectors, three on each side of the river, and fifteen secondary ones opening into the former, and fed by a vast number of subordinate sewers, intersecting the city in every direction. The dirt and sewerage are conveyed to large reservoirs, known as the *Voirie de Bondy*, where they are used as manure.

All the burial-places are without the inclosure of the city walls; that of Père la Chaise, on the north-east, is the principal, and is probably the most beautiful burying-ground in the world. Like all the other Parisian cemeteries it belongs to the city, and shares the fees between it and the poor. Père la Chaise is named after the superior of the College of Jesuits, who once owned the ground. It extends over more than 200 acres, and nearly £5,000,000 has been expended on it. Since the first funeral, on the 1st of May, 1804, more than 250,000 persons have been interred here. It contains about 15,000 tombs, of which nearly 3000 have monuments, many being of a magnificent character. The two other most important Parisian cemeteries are Mont Parnasse and Montmartre—the former 38, and the latter 31 acres in extent. In addition to these three great cemeteries there are twelve minor ones, of which, however, only eight are allowed to be open. The cemeteries would be insufficient to receive so many bodies, were it not that considerably more than half of them are deposited in the common grave (*fosse commune*). All burials in Paris are conducted by a public company—*Entreprise des Pompes Funèbres*—which has a monopoly of the business. The tariff and arrangements are fixed by the police. There are nine different styles of burial, varying in cost from 19 to 7184 francs. The company is bound to bury the poor for nothing, receiving, however, a subvention from the municipality in return for this service.

A considerable portion of the city on the south bank of the Seine overlies vast catacombs, not originally designed to accommodate the dead, but appropriated to that purpose from convenience. They extend under some of the more important public buildings, as the Luxembourg, Pantheon, and Observatory. These excavations were quarries, out of which the stone used in the superficial erections was obtained. When the old graveyards became overcrowded, they were all cleared out, and the bones, after being cleaned and carefully arranged, were deposited in the subterranean

passages and hollows formed by the quarrymen. It is supposed, as a moderate estimate, that they contain the remains of 3,000,000 human beings. Inscriptions indicate the quarters whence they were removed. Accidents having occurred by persons losing their way in the dark retreats, the catacombs are now closed to the public, except at stated intervals and under strict regulations. The *Mougue* is a mortuary for the corpses of unknown persons who have been drowned or have met with a violent death.

History, Sieges, Fortifications, &c.—Paris is mentioned by Cæsar under the name of Lutetia ("Bell. Gall." vi. 3; vii. 57, 58), and it was then the chief town of the Parisii, a tribe probably of the Belgic stock. In the division of the country made by the Romans, Lutetia was included in the province of Lugdunensis Quarta or Senonia.

For the next four centuries the place is hardly noticed. About 358 or 360 it took the name of the tribe to which it belonged—Parisii. It was the seat of a bishopric perhaps as early as the middle of the third century. In or about the year 494 it was taken by the Franks under Clovis, who made it his residence, and was buried there in 511. In the ninth century the Northmen or Normans attacked and pillaged the city several times. Under the Carolingians Paris was the capital of a county comprehended in the duchy of France. Hugues Capet inherited both the county and the duchy; and upon his assumption of the crown in 987 they became part of the royal domains.

Hugues Capet, now king, continued to reside at Paris, which thus again became the capital of the kingdom of the Franks, and for now nearly 900 years it has continued to be the capital of France. It has been progressing in extent, power, and population, almost uninterruptedly throughout that long period; and has been more closely connected with the history and politics of France than even London in respect to those of England. Several important European treaties have here been negotiated and signed, and notably that between Russia, Turkey, France, and Great Britain, at the close of the Crimean War, in March, 1856.

The great strength of the city having been proved by previous experience, King Philip Augustus, at the beginning of the thirteenth century, extended its fortifications, adding several hundred towers to the walls. In the latter part of the fourteenth century King Charles V. surrounded the new suburbs with a fresh *enceinte*, built a citadel called the Bastille, and constructed a fort on the Isle of St. Louis. Notwithstanding these new defences, the English, after the battle of Agincourt, 1420, took Paris. The Maid of Orleans, attempting to recapture it in 1429, was repulsed; but seven years later, through the gallantry of Dunois, the Bâtard Royal, the English were obliged to evacuate it.

King Henry IV. was the next to assail the capital. As he was a Protestant, it would not recognize his authority. Having defeated the Catholic League at Ivry, 17th March, 1590, he approached the city by forced marches; and occupying Corbeil, Lagny, and Creil, cut off the supply of provisions, then chiefly received by the river. He next planted his guns on Montmartre, and from this commanding position left the Parisians to choose between starvation and bombardment: 15,000 of the inhabitants died of hunger before negotiations were opened with the king. At that very moment, however, the Spaniards, who assisted the Catholic League, sent General Prince Farnese with a large army from Belgium to the rescue. Henry was thus compelled to raise the siege, and only entered Paris four years later, when, having embraced Catholicism, he was welcomed with the greatest enthusiasm.

The power of France rapidly increasing, Paris remained more than 200 years unvisited by an invading army. In the reign of Louis XIV. the mere idea of the foreigner venturing into the heart of the country had come to appear

to preposterous, as to lead to the razing of the fortifications. Louis XV., in 1726, again encircled the city with a wall, which, however, was not intended for military purposes.

In 1814 the allied armies appeared in front of Paris to avenge the deeds of Napoleon I. At that time Joseph Bonaparte acted as regent, and a few redoubts, hastily thrown up, were all the impediments in the way of the enemy; 25,000 regulars under Marmont and Mortier, and 15,000 national guards, with 150 guns, formed the city garrison. The allied sovereigns arrived on the evening of the 29th of March at the château of Bondy, and resolved to attack Paris by the right bank of the Seine. They planned three simultaneous attacks, and after a most severe struggle the city was compelled to capitulate on the 31st. The following year witnessed a repetition of the feat. On the 2nd of July, 1815, the Prussians, under Blücher, took Montrouge and Issy by storm, while Wellington forced his way into the northern and eastern suburbs, and on the 7th the English and Prussian guards once more trod the Boulevards.

Projects for fortifying Paris had been entertained from the Revolution in 1789, and whilst at St. Helena Napoleon ordered a memorial of his intentions to be drawn up. After the revolution of 1830 the project was again revived, and in 1831 the works were commenced by Louis Philippe; but on the return of peace, after the siege of Antwerp, they were abandoned for a second time. It was reserved for M. Thiers, in 1840, to carry out the projects to their fullest extent. The project proposed combined two plans, viz.—to have Paris fortified with circular ramparts as well as with detached fortresses. This was adopted, and resulted in probably the most complete and extensive military engineering works ever constructed. These consisted of an inclosure of a roughly pentagonal form, embracing the two banks of the Seine, bastioned and terraced with about 33 feet of escarpment faced with masonry. The continuous outline of the work was broken by V-shaped projections, the two sides of each of which were commanded by a flank fire. At different points were drawbridges, magazines, &c., and several military roads of communication. The distance of this regular zone or belt from the irregular cutting formed by the old wall of the capital varied from two-fifths of a mile to nearly 2 miles. The entire circle comprised a length of more than 20 miles. In their outer extent the ditches were of considerable width. The military road inside was paved. Near to this, and frequently parallel to it, embracing the entire series of fortifications, was a line which joined all the railways running into Paris and their eight termini. The exterior fortifications (*forts détachés*) were so many small but complete fortresses, with lodgings for at least 500 men each, and dwellings for the officers. All the forts communicated with each other, and with Paris, by telegraph.

Immense, however, as is this system of M. Thiers' fortifications, they proved in 1871 inadequate thoroughly to protect the city from modern rifled artillery. Their position, moreover, rendered an effective sortie extremely difficult, while, from commanding heights, the Germans watched in safety preparations made for sorties, and were consequently never surprised. Fairly awakened to their dangers, the French set to work, in 1872, upon defences which have rendered their splendid capital stronger than ever it was before, more difficult to invest, and more capable of making a prolonged resistance. The new works consist of detached forts upon commanding heights around and at a considerable distance from the city, forming a ring 77 miles in circumference. These forts are of such strength, and hold such commanding positions, and are so connected by protected communications, that a comparatively small efficient force can effectually hold them; and Paris now enjoys a security it never before possessed.

The surrender of the French army at Sedan on the 2nd of September, 1870, had scarcely been completed when the heads of the conquering columns were turned towards the French capital. The corps of Vinoy, which had escaped by a hair's breadth the fate of MacMahon, made good its retreat from Mézières, and arrived in Paris in time to take part in the defence. The forts were held by a garrison of marines, and were already fairly armed. Of field artillery there was only a scanty supply. The Mobile and the National Guard, with the exception of a few regiments, were still learning the rudiments of drill. On the 17th of September the Germans had reached the Seine at Ville-neuve, and commenced the passage of the stream to take up their positions to the south of the city. On the 20th of September the investment of Paris was complete, and as soon as the pleasure-loving Parisians realized what had happened they settled down to the work of defence in an entirely unlooked-for spirit of quiet, almost sad, and somewhat fatalistic patience. They had been expected to quarrel to the verge of civil war. They suspended all quarrels, one quarter alone making a single rush, which within twelve hours was put down by the armed citizens. They had been expected to be turbulent. They were blindly, almost passively, obedient to leaders chosen by themselves out of the streets, the Chamber, and the army, leaders who showed themselves as patient and as fatalistic as the people. Unaided by any prestige of rank, of official position, or even of former popularity, these leaders worked with the people; and in less than five weeks reduced anarchy to most formidable order. The forts were manned and armed; new and enormous works were thrown up. The *enceinte* was defended by a citizen army. A system of street defence by barricades was devised, and was intrusted to the Vicomte Henri Rochefort de Launay, leader of the most turbulent section of the populace. An army of 275,000 men was improvised in the *banlieue*. All metal factories were set to cast cannon, all bakeries to make bread, all inhabitants to throw up earthworks. Every citizen, married or single, was clothed in uniform, and taught drill. The system elaborated in the city for relieving distress whenever it became unbearable, was utilized for the distribution of rations. As work failed, the vast crowds of working men and women, 800,000 in number, were taken into municipal employ, and a scheme was extemporized for giving money instead of food to each man in distress, so that the grand corrective of wastefulness, personal self-interest, worked from the very first. Thus fortified against hunger by organization, and against assault by her military works, Paris, during four long months played her part, awaiting in hope, or doubt, or despair, but always in calm, the relief which never came. So utterly was she cut off from the world, that her only means of receiving news was through pigeons, her only method of transmitting orders the despatch of men in balloons. It was no part of her rulers' policy to try great sorties until support had arrived from without, and the only two tried failed through the want of tenacity, so marked at this period throughout France; but her impatient people waited and served, served and waited, like the most highly-disciplined troops. Gradually the food failed. The supplies had been stretched beyond all hope, but still the misery increased, and week after week, day after day, the people came nearer to starvation. In the first month the rations were pretty full; in the second, horse took the place of more accustomed flesh; in the third, horse was supplemented by dried fish, bacon, anything that could be called nourishing, and of this there was little; and in the fourth, all classes alike were reduced to flour ground from grain with the husk on, mixed with pease, rice, and dried grass. Among a population with whom eating had been a science, not a food riot occurred, nor was there an attack on the one privilege of the rich,

the right to buy at an enormous price a bad but sufficient meal. The death-rate doubled, tripled, quadrupled, and still the same calm prevailed. The Parisians suffered for France, and in that one thought all private suffering disappeared.

The besiegers at last became weary of their lives by reason of the constant strain, but there were disputes concerning the expediency, and even the possibility, of bombarding so huge a city. Germany cried loudly that her sons were being sacrificed through mistaken tenderness for an enemy who had brought the horrors of war once more upon the earth in sheer wantonness. There were cabinet councils and councils of war, till at last statesmen and soldiers almost quarrelled as to whose hand it was which held at rest those black-muzzled cannon pointed on Paris, nor suffered them to begin their deadly work. At last, however, on New Year's day, 1871, the blockade was changed into a bombardment; the arm of the gunner was held no longer either by general or diplomatist, and the black muzzles were no more silent. First upon the forts, then upon the streets, poured the deadly rain of missiles. Still the inhabitants held on, not making great sorties as other races would have done; but not fearing, not flying, not mutinying—exhibiting a spirit of patient heroism utterly foreign to the French character, which extorted the admiration even of the besiegers. Once only the patience of the people gave way, and when it was known that the food was done and capitulation inevitable, the most distressed of all the quarters, Belleville, the home of the workmen and the very poor, broke out in fierce, patriotic, but misguided rage, and was sent back to its den by musketry from the friends of order.

Nor was the conduct of the siege less worthy of note. It is probable that the calm, astute, and rather cruel leader of the German operations had expected civil war in Paris; but it is certain, from a paper of his own in the German military journal, that this aid failing, he was aware of the terrible task he had undertaken. With an army at first not 200,000 strong—for at first Metz was untaken, and the communications were fully defended—he had to invest a city with a radius of 32 miles, protect the investors from an army in the centre numbering 200,000 men, and defend his entrenchments from the attacks of all France. Those attacks were most dangerous. Roused by the genius of the Parisian representative, Léon Gambetta, a Frenchman of Genoese parents, best described as “the Marseillaise” incarnate, France, waking from the stupor which followed Sedan, sent army after army into the field. For men all Frenchmen were ready, and by lavish expenditure in America, in England, and in France itself, rifles, cannon, and equipments were hastily got together. From the west a large army twice approached the city. From the north a good army advanced three times. From the south-west an army better than either advanced within 50 miles of the besiegers' lines. Still neither the besieging army nor its chief ever relaxed their grip. On through the failing autumn, and the deepening winter, and the fearful cold which, as it happened, distinguished January, the constant Germans kept their unwearied watch, repulsing little sorties, defeating great enterprises, gathering food by forays, collecting fire-wood by plunder, devastating the ring of villa cities round Paris, making for themselves shelter in palaces or in outhouses, but always there, always ready in efficient order to the word of command. As each army approached Von Moltke met it, now by the daring expedient of sending out reinforcements, till his thin line round the city grew imperceptible; now, when Metz had fallen, by directing its besiegers against relieving armies; and again, even after Metz, by suddenly lifting an entire *corps d'armée* from before Paris, and despatching it to the north. The risk was often great. Thrice during the siege the garrison might have crushed their foes; twice a

half successful sortie might have succeeded; once—after D'Aurelles' first advance through Coulmiers—orders were on the point of being given to raise the siege. And still the line, strong or thin, held on, and still the calm man of seventy rayed out or brought up the necessary force, and adhered to his great design. During all that terrible time, though he was 300 miles from his base, the supply of munitions never failed, the troops were never left unfed, the force necessary to defeat an attack was never absent from the threatened point. Disease menaced the camp. Nostalgia broke out in the army with a fury which at one time menaced discipline. A deep despondency, a despondency as dangerous as fear, settled for three weeks upon the besieging army. And still General von Moltke, true representative of German soldiership, fought on unmoved, or seemingly unmoved, working out “his great problem,” as if his men had been chessmen and he the prince of players. Never was there such a triumph of scientifically organized force over the patriotic virtues—never in history was such a feat of war accomplished. General von Moltke, after a siege of four months, captured the greatest capital of the Continent, inhabited by 2,000,000 people, defended by 300,000 drilled and 200,000 partially drilled men, in the teeth of the efforts of half a million of volunteers, well armed and fairly equipped, to bring the city relief. Never before had a capital proved such a fortress. Never before had a metropolitan population shown such patience, passive courage, and self-control. Never before had a besieging army performed a task which might have seemed so completely above its strength.

The city capitulated to the Germans on 25th January, and they immediately took possession of all the forts around it. The garrison were treated as prisoners of war (except that the National Guard were allowed to retain their arms), and a war contribution of 200,000,000 francs, or £8,000,000, was exacted from the city. After the onerous terms of peace exacted by the Germans, it was hoped that the French capital might be spared the degradation of feeling the foot of the conqueror on her neck, but the German people had said that the humiliation must be complete before France would acknowledge herself utterly vanquished. Mindful of the old triumphs of Rome, they wished that their army also should have its triumphal march. The proposal was strenuously resisted by the French authorities, and a compromise was at length effected, by which one division occupied for twenty-four hours the district from the Bois de Boulogne to the Louvre; the inhabitants of the other parts of the city being kept behind a strong cordon of French troops. It was feared that a collision would occur, the consequences of which would have been most disastrous, but this was happily prevented.

In anticipation of the opening of Paris, hasty but generous efforts were made by a committee of London citizens, under the presidency of the lord mayor, to provide for the immediate wants of the famishing multitude. Subscriptions flowed in from all parts of the kingdom, which were given out as soon as they arrived, provisions of all kinds being purchased and despatched to Paris, where they were distributed under the supervision of Mr. George Moore and Colonel Stuart Wortley, two of the members of the committee who proceeded thither for the purpose. The entry of the waggon-loads into the city was a sight never to be forgotten, and the liberal help thus promptly given, to the extent of £126,609, awakened in the capital and throughout France feelings of gratitude, which were warmly and generously expressed.

On 10th March the French Assembly, which had been sitting at Bordeaux, resolved, by a large majority, to transfer its sittings to Versailles—an attempt to fix upon Paris being resisted by the president, M. Thiers, and rejected by the Assembly. This fear of the capital speedily produced most fatal results, for scarcely had the Germans left when

the Red party made a desperate attempt to seize supreme power. The National Guards, whom the folly of the French negotiator, M. Jules Favre, had left in possession of their arms, refused to acknowledge the authority of the National Assembly. The hesitation and delay of M. Thiers and his colleagues allowed an *émancipation* to develop into a revolution; the government had to seek safety in indecorous flight, and a socialist republic was proclaimed in the capital. Fortunately the army rallied loyally to the support of the National Assembly at Versailles. The provinces declined to support the cause of the Commune, and Paris had to undergo a second siege, conducted by the French soldiers against a French garrison, in the sight of the German troops who occupied the suburbs. The Commune—which commenced its career by the assassination of Generals Léonard and Thomas, and by the arrest of General Chanzy, the one hero of the war—contrived within the space of a few short weeks to emulate the extravagant horrors and follies of the Reign of Terror, and culminated in a crime to which the annals even of the *Septembriseurs* afford no parallel. When the defence of Paris became desperate, the Versailles troops were allowed to enter without any serious opposition, the prisoners in the hands of the Commune were murdered in cold blood, and the city was deliberately set on fire by the miscreants who had made themselves her tyrants. Happily the ruin fell far short of that contemplated by its authors, though it was both terrible and disastrous in its magnitude; among the most important buildings destroyed being the magnificent palace of the Tuileries and the Hôtel de Ville.

PARIS, in the Greek mythology, was that handsome fascinating son of Priam, king of Troy, whose beauty and courage directly brought about the war of Troy and all that resulted therefrom. His mother Hecabê (Lat. *Heccuba*) dreamed before his birth that she was delivered of a firebrand, and this was rightly interpreted to mean that the infant soon to be born should be the cause of his father's house being burned down. It was decided to throw the child out on the slopes of Mount Ida and leave its fate to chance. A shepherd found the baby and took it home. Paris grew up to be the loveliest youth in all the Troad, and so courageous against the enemies both of his flocks and of his companions that he gained the second name, by which Homer usually calls him, of "protector of men," Alexandros. He discovered his birth, was received in Troy as the son of the king, and married Oinônê, daughter of the river-god Kebrên, still dwelling, however, as a shepherd on Mount Ida.

His father came three contending goddesses, Hêra, Athênâ, and Aphroditê, to be judged by this handsome shepherd-prince as to who was entitled to the apple the goddess Discord had thrown "to the most beautiful." It would seem fairer to have left Paris to his decision, but the goddesses sought to influence his judgment by gifts. Hêra promised him an empire, Athênâ glory in war, Aphroditê the loveliest woman in the world, and it was to the last that Paris adjudged the apple.

Guided by the goddess of love and beauty, deserted by the goddesses of queenly pride and of wisdom and courage, Paris easily gained his prize, and stole away Helena from her husband, the Greek king Menelaos, but he lost his courage and his fair fame. Homer describes him as even cowardly and effeminate, and as one upon whom his brave brothers and friends looked askance as the source of evils which he could not and tried not to lessen. For soon after Paris brought Helena home to Troy, her injured husband and all the princes of Greece (previously bound by an oath to protect her marriage, for they had all been suitors for her hand) invaded the coast of Asia Minor, and the ten years' siege of Troy began. Paris took but a feeble part in it. Once truly he fought Menelaos in single combat, but he was worsted, and would have been slain had not his constant protectress, the goddess Aphroditê, carried him

away to safety. Yet after all it was the effeminate Paris who killed Achilles by shooting him with an arrow in the heel, his only vulnerable part. (The rest of his body was magically protected.) Troy fell not long after, and Philoktêtês, whose arrows (a gift of Hêraklês) dealt death on every hand in the fearful carnage at the sack of the city, wounded Paris among others. The wounds of these arrows were fatal. Paris sought for his long deserted wife Oinônê to help him, but she could not endure the meeting. Afterwards, learning his desperate state, she set out for the ruined town, prepared to forgive him and to try and heal his hurt; but she was too late—Paris had died. Some friends were burning the body on a hastily constructed funeral pile, and the remorseful wife flung herself into the flames and perished.

PARIS is a genus of plants belonging to the order LILLIACEÆ. *Paris quadrifolia* (herb paris), the only British species, is found in damp woods in England. It is a perennial, sending up every year a stem which bears at its summit a whorl of four large ovate acute leaves, and a single terminal large green flower. The juice of the berry is acrid and is considered poisonous, but has been used to cure inflammation in the eyes. The leaves and stem also were formerly employed in medicine.

PARIS, MATTHEW OF, a monk of St. Albans, in the middle of the thirteenth century, who received his surname from having studied at the University of Paris, the most famous seat of learning at this time, took up and rewrote the Chronicle of Roger of Wendover, another monk of his own abbey. As long as Roger's account serves there is only so much difference as is due to Matthew's better style, but onwards from 1235 (when Roger ceases) there is a very remarkable difference. It is really surprising to read the plain truths which the fine old monk tells of both pope and king in such plain language. Those who remember that he was writing under the evils due to the weak, unscrupulous, tyrannical rule of Henry III., will readily imagine that subjects for his scathing pen could not be lacking. The Chronicle of Matthew of Paris ("Historia Major") extends to the year 1273, the year after the accession of Edward the Great. It is written in Latin.

PARISH, a term originally used to denote a certain definite circumscribed territory, varying in extent and population, but annexed to a single church, whose incumbent was entitled to the tithes and spiritual offerings within the territory. It is still generally used in the same sense when ecclesiastical matters are referred to, but the word has also acquired in addition several distinct meanings, to which reference will be made in the present notice. Its early form *parische* is from the French *paroisse*, which is from the Greek *paroikia* (through the Latin *parœcia*). The Greek word meant originally simply "neighbourhood" (*para*, near, *oikos*, a house), and in early Christian times acquired its special church meaning.

In the early ages of Christianity the term appears to have been used in some parts of Europe to signify the district or diocese of a bishop, as distinguished from the "provincia" of the archbishop or metropolitan (Selden's "History of Tithes," chap. vi. sec. 3). These large ecclesiastical provinces were gradually broken down into subdivisions, for which ministers were appointed, either permanently or occasionally, who were under the rule of the bishop, and who, being paid out of the common treasury of the bishopric, had no particular interest in the oblations or profits of the church to which their ministry applied. In England it seems probable that the creation of parishes was gradual, beginning about the end of the seventh century, and was not fully completed until the reign of Edward III. As population increased the spiritual necessities of the people were but inadequately supplied by the bishoprics and monasteries, and lords of manors began to build upon their own demesnes churches and oratories for the religious pur-

poses of their families and tenants. For a long period, however, the ecclesiastical revenue of each bishopric was carried into one common fund, which was placed at the disposal of the bishop, and was supposed to be divided into four parts, one being allotted to the bishop, one to the clergy, one to the poor, and one to the erection and maintenance of the ecclesiastical buildings. By degrees, beginning in the rural parishes, an alteration of this arrangement was effected, and when a church was erected and provision made for its support, it was usual for the bishop to consecrate it, and consent that the resident incumbent should receive for his maintenance, and for the use of that particular church, the tithes and offerings of the inhabitants of the parish, as well as any endowment or salary which the founder annexed to it. This endowment or salary usually consisted of a glebe, or a portion of land appropriated for that purpose, the produce of which became the settled revenue of the church, and was annexed to it in perpetuity. Another concession made to the lay-founder was probably the patronage or right of presenting the clerk of the church, which right by the primitive constitution belonged exclusively to the bishop. The size of the ecclesiastical parishes varies greatly in England, those of the northern counties being, generally speaking, seven or eight times the area of those in the southern. Under the powers given by the Church Building Acts, the first of which was passed in 1818, many large or populous parishes have been subdivided into smaller ecclesiastical parishes—each provided with its own church, incumbent, and church officers.

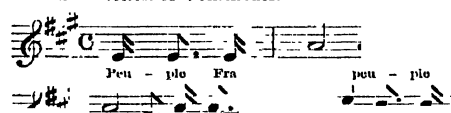
For the purposes of civil government the term parish means a district for which a separate poor-rate is or can be made, and by the Poor Law Amendment Act of 1866 this definition is to be used in interpreting all statutes, except where the context plainly shows that the ecclesiastical parish or some other division is referred to. In harmony with this law, in the census returns of 1871, a new term, civil parish, was introduced to designate the places separately rated to the relief of the poor. In many instances the old ecclesiastical parish represents the civil parish also, but owing to subdivisions, amalgamations, and other causes there are many exceptions to this rule. The chief part of the parochial organization is the vestry meeting, at which the ratepayers either directly or through their representatives appoint the parochial officers, and arrange matters for the maintenance of the poor, the repair of the highways, the management of the property of the parish, &c. Common vestries are meetings of all the ratepayers assembled on a three days' notice; select vestries are those which are regulated by local custom.

In the Burial Acts passed between 1852 and 1875 certain areas are treated as parishes for the purposes of those Acts, but these areas have no necessary connection with either the ecclesiastical or civil divisions over which they extend. The same observation applies to the parish separately assessed for land-tax purposes, and the districts described as parishes in the Highway Acts. England was divided, according to the census of 1881, into about 16,000 parishes, townships, and places.

In Scotland a parish seems anciently to have signified the diocese of a bishop, but is now taken to mean the territory of a particular church belonging to the Establishment, and entitled to the tithes within that territory. The bounds of each parish are rigidly fixed, and are presumed to have been made so at some period by the competent tribunals. This process still goes on, as from time to time it becomes necessary to divide some parishes and unite others. To the Court of Session the necessary powers for these purposes are now intrusted. The regulating Acts are, 1707, c. 9, 4 and 5 Will. IV. c. 41, and 7 and 8 Vict. c. 44. In Scotland there are 887 proper civil parishes, and in addition 325 *quod sacra* parishes erected under the 7 and 8 Vict. c. 44.

PARISH CLERK, a person whose duty it is to assist the parson in the rites and ceremonies of the church. He is generally appointed by the incumbent. In churches or chapels erected under the Church Building Acts the clerk is nominated annually by the minister. In some places he is chosen by the inhabitants. In small parishes the offices of parish clerk and sexton are united in one person. In 1844 an Act was passed (7 & 8 Vict. c. 54) "for better regulating the offices of lecturers and parish clerks." In Scotland this officer is called the session clerk, and generally, in addition, holds the offices of parochial schoolmaster, registrar, and inspector of the poor.

to the fine singing of the tenor N... and ... by Casimir Delavigue, and the tune was selected by a friend from a collection of Volkslieder.



PARITIUM is a genus of plants belonging to the order MALVACEÆ. The Mountain Mahoe (*Paritium elatum*), a tall tree confined to Cuba and Jamaica, furnishes a peculiar greenish-blue timber used in Jamaica for cabinet-making. The beautiful lace-like inner bark, called Cuba bust, is used for tying round bundles of Havannah cigars, and is also used by gardeners. From the fibres of this and other species the natives make ropes, mats, clothes, &c. The genus is distinguished by the presence of an epicalyx, by the column of stamens having five teeth at the top from which protrudes the five-cleft style, by the capsule being spuriously ten-celled, and by the large glandular leaves.

PARK. This term, in its legal significance as a privileged enclosure for beasts of the forest and chase, is at the present day nearly obsolete. Under the ancient forest laws the franchise of the highest degree was that of a forest, which was the most comprehensive name, and contained within it the franchises of chase, park, and warren. The only distinction between a chase and a park was that the latter was inclosed, whereas a chase was always open, and they both differed from a forest, inasmuch as they had no peculiar courts, nor any particular laws, being subject to the general laws of the forest, or, as Sir Edward Coke maintains, to the common law exclusively of the forest-laws (4 "Inst." 314). The first great park formed in England was that of Woodstock, in 1125. St James' Park was thrown open to the public in 1668. Hyde Park became crown property in 1589. In modern times the term is applied to the inclosed grounds around a mansion, including woods, coppices, pasturage for deer, sheep, or cattle, and all parts of an estate which are devoted more to pleasure than to profit. *Public parks* have of late years been opened in the vicinity of large towns, intended as places of healthy resort for the inhabitants.

PARK, MUNGO, a celebrated African traveller, was born 10th September, 1771, at Fowlshiels, on the banks of the Yarrow, not far from Selkirk in Scotland. His father was an intelligent and successful farmer. At the age of fifteen Mungo Park was apprenticed to Mr. Thomas Anderson, a surgeon in Selkirk, with whom he resided three years—removing, in 1789, to the University of Edinburgh. There is nothing left on record of his aca-

demical life, except that he devoted considerable attention to botany. On the completion of his studies at Edinburgh, Park repaired to London, where he was introduced to Sir Joseph Banks, through whose interest he obtained the appointment of assistant-surgeon to the *Worcester*, East Indiaman. He sailed in February, 1792, on a voyage to Sumatra, and returned to England in the course of the following year. Soon after his return he offered his services to the African Association as the successor of the unfortunate Major Houghton, and being accepted he sailed from England, 22nd May, 1795, and reached Pisania, a British factory about 200 miles up the Gambia, 5th July. He left Pisania, 2nd December, 1795, and after passing through the territories of a number of petty negro chiefs, he was induced to adopt a more northerly route across the territory of Ludunar, then governed by the chief of a predatory horde of nomad Moors. He reached Yarra, the frontier town of this state, 18th February, 1796. Ali, the Moorish chief, detained him a captive till the 1st of July. When he made his escape he possessed nothing more than a horse with its accoutrements, a few articles of clothing, and a pocket-compass. Undismayed by his destitute condition, he pushed on towards the river of his quest, which he reached at Sego, after a journey of fifteen days: he explored the stream downwards to Silla and upwards to Bamkokoo, then crossed a mountainous country to Kamalia, a Mandingo town. Here, 500 miles from the nearest European settlement, his health gave way. For upwards of a month he was rendered helpless by a fever, and was detained in the same place five months after his recovery before he could obtain the means of journeying to the coast. At last, 10th June, 1797, he returned to Pisania, after a series of lonely and toilsome wanderings which had occupied upwards of nineteen months. On his return to England the composition of a narrative of his travels occupied him till the spring of 1799, when it was published under the title of "Travels in the Interior of Africa."

In 1799 he retired to his native country, and in the August of that year married the daughter of Mr. Anderson, with whom he had served his apprenticeship. Two years afterwards he settled at Peebles, and obtained practice as a surgeon; but he was not in his element, and his mind still ran on foreign adventure. In the autumn of 1803 he accepted a proposal from government that he should command an expedition of discovery into the interior of Africa, and on 30th January, 1805, the expedition sailed from Portsmouth. Park had adopted the opinion that the Congo and the Niger were one stream; and his plan was, with a supply of merchandise sufficient to defray travelling expenses, and a body of soldiers sufficient to insure immunity from hostile attacks, to cross from the Gambia to the Niger, and then sail down the stream to the ocean. The expedition left Pisania, 4th May, 1805, and arrived at Foulah Dongou with thirty-three white men. From Foulah Dongou to Sego (which was eight days' march, but which is generally performed in three days by a negro), they lost twenty-six men by the rains, damps, &c. The expedition afterwards reached the kingdom of Houssa, where Park and his companions were either murdered by the natives, or, more probably, drowned in passing a dangerous rapid while trying to escape. This catastrophe occurred towards the close of 1805.

PARK OF ARTILLERY, an assemblage of the heavy ordnance belonging to an army, with its carriages, ammunition waggons, and stores, on ground contiguous to that which is occupied by the troops when encamped.

The park is formed in the immediate vicinity of roads by which the artillery may be readily moved to any spot where its service may be required; it is usually in rear of the troops, the guns being arranged in one line if the ground will permit. At the siege of a fortress the park is situated

between the army and the place, and it should be beyond the range of the artillery of the latter. If possible, it should be behind some rising ground, and on a spot from whence the artillery may be speedily brought up to the trenches or batteries.

A quarter-guard, as it is called, is posted at a certain distance from and opposite the middle of the front of the park; the gunners' tents are arranged along the two flanks; those of the commissioned officers are in the rear; and behind them the horses are generally picketed in one line or more parallel to that of the guns.

PARKER, MATTHEW, the second Protestant Archbishop of Canterbury, was born at Norwich, 6th August, 1504. His father, who was a calenderer, was able to give him a good elementary education, and though he died when Matthew was twelve years of age, the mother was able in 1521 to send her son to Cambridge. He became accordingly one of the students of Corpus Christi College, and was so diligent in his studies that in 1521 he was admitted B.A. Soon afterwards he was made a deacon and priest, and in 1527 was elected to a fellowship. By this time his ability had become recognized, and he had been invited by Wolsey to become one of his professors in the college which he meant to found at Oxford. This honour, however, Parker declined, probably in consequence of having attached himself to the reforming party in the church. He was on terms of friendship with Bilney, and when the latter suffered martyrdom at Norwich in 1531, Parker attended him during his last hours. When Cromer became Archbishop of Canterbury, Parker was invited to court, and in 1535 the queen, Anne Boleyn, made him her chaplain. The same year he was appointed dean of the College of Stoke Clare, where he continued to reside until 1545, being created a D.D. in 1538, and made a canon of Ely in 1541. In January, 1545, he was elected vice-chancellor of the University of Cambridge, and soon afterwards he married a Norfolk lady named Margaret Harleston, who ever afterwards proved a true helpmeet to him. There is a good story of Elizabeth's behaviour to this lady, which well illustrates the fluctuating temper of the times in religious matters. The queen could not stomach Parker's marriage, used as she was to a celibate priesthood; therefore she marked her displeasure in taking leave after her first visit to the new household by saying to her hostess, with feigned hesitation, "*Madam* ('Mrs.') I may not call you, and *Mistress* ('Miss') I am loth to call you—however, I thank you for your good cheer." On the accession of Mary, Parker resigned his office and sought safety in retirement, and though during the persecution he was hunted about by the emissaries of the queen, he succeeded in evading his enemies without having to leave the country. After her death he wished to resume his duties at Cambridge, but in 1558 he was summoned to London, and appointed to the primacy. He was elected to this office in August, 1559, and consecrated in the chapel at Lambeth Palace on 17th December of the same year. The absurd story of his irregular consecration at the "Nag's Head" in Fleet Street, which was not circulated until forty years afterwards, has long since been conclusively disproved, the evidence in favour of the regularity of the proceedings proving on investigation singularly full and satisfactory. He occupied the see more than fifteen years, during which time he was assiduously employed in watching over the interests of the newly organized church, and in endeavouring to impart to it order and stability. The Thirty-nine Articles were passed by Convocation under his presidency in 1562, and in 1566 he issued his celebrated "Advertisements" for the regulation of public worship. He was fully imbued with the spirit of the Reformation, but while he steadily repressed all reactionary tendencies on the part of the clergy, he had no sympathy with the Puritans, and treated them with much harshness and severity. To the

objections raised by some of the members of the Puritan party to the ceremonial and use of the vestments he had enjoined, he simply replied, "They must conform to the habits, or part with their preferments," and he stretched the law to its utmost limits in his efforts to enforce conformity. He died 17th May, 1575, and was buried in Lambeth Palace.

As an author he does not take a high place, but he was an industrious editor, and a very diligent collector of ancient books and MSS. The most important work associated with his name was the "Bishop's Bible," which was completed under his auspices in 1568. The work entitled "De Antiquitate Britannicæ Ecclesiæ," published in his name in 1572, is believed to be largely the work of his secretary. He was one of the first to revive the study of Anglo-Saxon literature, and he edited and published several of the chronicles and other works of the early English writers. As, however, he dealt very freely with the texts of these worthies, his editions have little or no value for the historical student. Somewhat unscrupulous in acquiring wealth, he spent it freely in the encouragement of learning and in charity. His own college of Corpus Christi received from him a substantial endowment of money, and he bequeathed to it his valuable collection of MSS. Another title to fame is that he was one of the founders of the Society of Antiquaries.

(See Strype's "Life of Archbishop Parker," folio, 1711, three vols. Oxford, Clarendon Press, 1824.)

PARKER, THEODORE, a distinguished American preacher, author, and social reformer, was born at Lexington in the state of Massachusetts, 24th August, 1810, being the youngest of a family of eleven children. His father was a farmer and mechanic, and he himself, when released from his studies at the district school during the summer, was engaged about the farm or in the workshop. From his childhood he felt he was to be a minister, and keeping this end constantly before him, he read and studied with wonderful zeal and industry. By acting as a winter schoolmaster he saved enough to enter Harvard College in 1830, and he contrived to support himself during his various terms by means of private tuition. During his theological course, which he commenced in 1834, he received some help from a poor students' fund, and by studying fourteen hours a day he was able to make acquaintance with a large number of languages, ancient, Eastern, and European, as well as keeping up with the college course of study, and reading largely the critical and theological works of Germany. In 1836 he took his degree, and in 1837 was appointed pastor of a Unitarian church at Roxbury, a village situated a few miles from Boston. In 1840 he became a regular contributor to the *Christian Examiner*, displaying in his essays a spirit of bold inquiry, an originality of view, and a depth of thought which attracted very general attention. He had been trained in the Unitarianism of the old school, but his studies had undermined his belief in the infallibility of the Bible, in miracles, and in the exclusive claims of Christianity, and in 1841 he gave an eloquent and public expression of his modified opinions in a discourse delivered at Boston on "The Transient and Permanent in Christianity." This sermon not only aroused against him the active hostility of the orthodox evangelical churches, but it caused him to be repudiated by most of the Unitarian ministers of Boston and elsewhere. He found, however, some zealous friends among the laity, and during the winter of 1841-42 he delivered a course of lectures in the Masonic Hall at Boston. The substance of these lectures was afterwards published as the "Discourses on Matters pertaining to Religion," a work which attracted much attention in Europe as well as America, and which still retains much of its original popularity. After a prolonged visit to Europe in 1843-44 he settled at Boston as the pastor of

an Independent Unitarian congregation, which met in a large music hall at Boston, and here he continued to preach regularly during the next fourteen years. He had during this period one of the largest congregations in America to minister to, but in addition to his pulpit labours he became a busy controversialist and a popular lecturer, gradually drawing round him a large circle of enthusiastic disciples. An ardent abolitionist he displayed the utmost fearlessness in his assaults upon slavery with tongue and pen, while he was one of the leading spirits in the management of the celebrated "underground railway" by which fugitive slaves were assisted to escape. He also helped to furnish John Brown with means for carrying out his schemes of liberation. In 1855 he was indicted at Boston and tried for a speech which he had delivered against kidnapping. By 1859 his incessant activity of mind and body had ripened the seeds of consumption which he had inherited from his mother, and he was attacked with bleeding from the lungs. In search of health he journeyed to Santa Cruz, and afterwards to Europe, but he died at Florence, 10th May, 1860. His valuable collection of books, amounting to 13,000 volumes, he bequeathed to the Boston Free Library.

Theodore Parker possessed an ardent warmth of heart, which displayed itself in the most affectionate devotion to his friends, and in the most fearless and self-denying championship of all whom he regarded as defrauded and oppressed. In theology he regarded himself as an apostle of theism, and believing that the distinctive doctrines of Christianity were being resolved by criticism into mythology, he sought to establish a system based upon what he termed "the belief in the Infinite God." He considered the apprehension of God, of the moral law, and of immortality, to be instinctive intuitions of the human mind, and sufficient to form a foundation for all religious emotion and practice. The most important of his works, viz.—the "Discourses on Matters pertaining to Religion," "Ten Sermons of Religion," and "Theism, Atheism, and the Popular Theology," have passed through several editions since his death. A complete edition of his works, edited by Miss F. P. Cobbe, was published in London, in twelve vols. in 1863-67; and by H. B. Fuller, in ten vols. at Boston, in 1870. The life of Theodore Parker has been written by the Rev. J. Weiss (two vols. New York, 1863); the Rev. O. B. Frothingham (New York, 1874); by P. Dean (London, 1877), and by Reville (Paris, 1865).

PARKIA is a genus of plants of the order LEGUMINOSÆ and suborder Mimosa. The genus contains only a few unarmed trees, which are found on the west coast of Africa, the peninsula of India, Java, Brazil, and Surinam. The African Locust Tree (*Parkia africana*) is a tree some 30 or 40 feet high. The Soudanese call it the Douira, and use it for various purposes. The farinaceous pulp surrounding the seeds is eaten, and also made into a pleasant drink when steeped in water. The seeds are roasted as coffee is with us, then bruised and allowed to ferment in water, after which they are pounded into powder and made into cakes. The Douira tree is also found in tropical America, having been imported by the negroes.

PARKINSONIA is a genus of plants of the order LEGUMINOSÆ and suborder Cæsalpinieæ. *Parkinsonia aculeata*, called in Jamaica the Jerusalem Thorn, is cultivated in nearly all tropical countries, and employed in such climates as an ornamental plant, and especially for the construction of hedges, for which its strong spines render it well adapted. In Mexico the natives employ it as a febrifuge and in cases of epilepsy.

PARLEMENTS, LES. The *Parlements* of France were merely bodies of judges and law officials, with whom were some few nobles who held nominal legal appointments. They had no representative character whatever. They must be sharply distinguished, therefore, from the partly elective body in England called a Parliament. Each large

province had at length its parlement in France, its collective legal body, which registered the royal edicts as well as administered the royal justice.

Parlements arose from the sincere wish of the good Louis IX. (Saint Louis) to put an end to the cruel tyranny which his great barons wielded over their trembling serfs. He took the famous pandects of Justinian, the code of law of the ancient world; and with the full force of his authority he insisted upon the barons abiding by its just provisions. The barons submitted to the king's order, but a curious difficulty arose. Very few of them could read, and none at all of them could read Latin. Legal scribes were therefore called in to translate, and what was quite as necessary, to expound the ancient laws. To three chief vassals of the crown, three bishops, and nineteen noblemen were added eighteen of these men of law. In the end, as might be expected, all the work fell into the hands of the latter, as the barons and noblemen quickly grew weary of the unintelligible verbiage. The lawyers further sought to consolidate their new feudal power by pleasing the king in supporting his authority against that of the barons in every case. The power of the parlement grew, and Louis XI., to strengthen it as an arm against his powerful vassals, first gave it the germ of its great power by declaring them inalienable. The irremovability of the judges and law officials at once enabled them to sell their charges, and henceforth ready money formed the only passport to high judicial office. Louis XI. created the local parlements of Grenoble, Bordeaux, and Dijon, in addition to the original royal court, which Philip the Fair (Philippe IV.) had in 1302 made permanent at Paris, granting it an old palace which it at once named Palais de Justice. Little by little the parlement of Paris gained many customary privileges, chiefly in the nature of validation of the royal decrees; but it was reduced at one blow to a simple court of justice by Louis XIV. about 1670, with the derisive permission to register the royal edicts as before, coupled with a prohibition to protest against them (if need were for that) until eight days after their registration. In the decay of the Grand Monarque and under the regency the power of these courts revived, and by the middle of his reign Louis XV. saw the parlements, now twelve in number, more powerful than ever. In 1763, when a long reign of frightful disorders had completely ruined the finances, the parlement of Paris took the bold step of delaying its registrations, while that of Besançon refused to register the king's laws until a reform of the finances was inaugurated. Many magistrates were accordingly exiled, but the parlement of Paris, bolder as the proofs of the king's weakness accumulated, now set up a theory that the various parlements really formed one great legal registering body, and that neither laws nor taxes were valid without its sanction. Louis sternly informed them in 1766 that "to the king alone belonged all legislative authority without dependency or participation." Evidently Louis, following his great-grandfather (Louis XIV.), was aiming at absolute monarchy, while the parlement sought to found an oligarchy. At the same time the parlement of Brittany instituted a process against the Duc d'Aiguillon (favourite of the infamous king's-mistress Dubarry), who had very cruelly misgoverned that province. The king, at the prayer of the woman Dubarry, ordered the Breton parlement to proceed no further against the duke; and the latter, the Abbé Terray, and the Chancellor Maupeou (a renegade courtier, once president of the Paris parlement), seeing the incessant troubles the parlements were giving, determined to sweep away the whole of them. All the members of the Paris parlement received *lettres de cachet*, exiling them to all kinds of places, and while they were thus scattered, Maupeou named certain councillors of state and other functionaries as a new parlement, and proceeded to re-register the decree forming the new body and disbanding the old. All France shuddered to see the last

bulwark against uncontrolled despotism thus disappear. Maupeou continued his work with the provincial parlements, pursued by a howl of execration, from princes of the blood down to peasants. The first act of Louis XVI. on his accession in 1771 was to undo this work and restore the ancient parlements just as they were before. But the popularity he thus gained was only temporary. In 1787 the finances were at a terrible pass again, and the parlement of Paris, when a timber-duty and a stamp-duty were presented, refused to register any more taxes until the finances had been regulated. Moreover, they declared it was not in their functions, although they had wrongly usurped that office, to vote money. Such votes ought to be given by the States-general, a body somewhat resembling the English Parliament in its broad outlines. Louis exiled them to Troyes for answer, and kept them there for more than a month. On an understanding of submission the parlement returned 19th November, 1787, and the king met it at a royal session. Still the States-general were demanded by many speakers, and finally the king, annoyed by the long resistance, ordered the registration of the tax-edicts without further debate. The Duke of Orleans (afterwards known as *Philippe Egalité*) rose and addressed his royal cousin. "Sire, it appears this registration is illegal. It ought to be plainly said that it is by the express order of your Majesty," Louis answered, "It is legal, because I will that it is so. You may do what you like" (*Vous êtes bien le maître*). After this, *lettres de cachet* exiled Orleans and other ringleaders of the revolt, while the parlement was summoned to Versailles, and the protest it had made was torn from its journals. In the following year, 1788, the minister De Brienne resolved to repeat the policy of Louis XV., dissolve all the parlements, and create an obedient royal body in their stead, a "plenary court." The necessary edicts and the necessary *lettres de cachet* were all being secretly printed at Versailles, when a chance betrayed the plot to D'Esprémeuil, who at once convoked a meeting of the parlement and informed them of the whole thing. He was at once exiled by *lettre de cachet*; but the parlement decreed itself in permanent session and refused to give up its loyal member. Eventually, therefore, occurred a similar scene to the *comp d'état* of Cromwell in our own country, though both soldiers and parlement represented far other causes. Captain D'Agoult, with the Gardes Françaises, arrived from Versailles, executed the warrant, and moreover turned out the refractory assembly, 167 by number, and locking the door of the Palais de Justice, returned to Versailles with the key in his pocket (3rd May, 1788).

Necker, in that sudden access of mistaken joy, when all was at last to be set straight, as men thought, recalled the poor parlement 22nd September, 1788; but it never did much more service. The revolution had now begun in earnest, and it was no work for lawyers. On 13th November, 1790, Bailly, the mayor of Paris, sealed up the Palais de Justice, and some such formality was gone through with the other eleven provincial parlements; for some months previously the Constituent Assembly had declared them all "in permanent vacation," and it needed only the actual closure to dismiss them for ever.

The astonishing thing about the Paris parlement (and the history of all the provincial ones has many points of resemblance), is that although a close corporation, thoroughly rotten in constitution, a handful of scheming nobles and 150 greedy lawyers, all of whom had simply bought their right to extort fees from the public at large, they should yet have done such notable service to justice and to liberty.

PARLIAMENT, IMPERIAL, the legislature of the United Kingdom of Great Britain and Ireland, consisting of the king or queen, the lords spiritual and temporal, and the commons.

History.—The name is derived from the French *parler*,

to speak. But the legal synods bearing the name of PARLIAMENTS in France have no analogy with our council; that must be sought in France in the *States-general*, a body very rarely summoned. The word was originally written *Parlement*, as in French, and although the spelling has changed the pronunciation is still, with the great majority of the people, unaltered. The earliest mention of the word "parliament" in the English statutes is in the preamble to the statute of Westminster in 1272. For the origin of the institution itself, however, we must go back to Anglo-Saxon times. The Teutonic races who conquered Britain had already in their original homes acquired a certain amount of self-government, and as they became established on the territories from which they had driven the Britons, they continued to hold regular councils for the settlement of their political affairs, which were presided over by the chiefs, and at which every ordinary freeman had the right to vote. In course of time, with the growth of civilization, it became customary for each township to settle its municipal affairs by means of a local council of the freemen, and for the small local councils to send certain of their members to represent them at the "shire-moot," a larger assembly, which exercised jurisdiction over a shire or district comprising several hundreds. Of still greater importance was the WITENAGEMOT, or council of the wise men, which was assembled in each of the early English kingdoms, and which possessed extensive legislative authority over both secular and ecclesiastical affairs. After the consolidation of the separate kingdoms into one realm, the Witenagemot became the deliberative and legislative assembly for the whole country. In its constitution it was hardly a representative assembly, but it appears to have been made up of the higher ecclesiastics, the king's *gesiths* and *thegns*, the officers of state, and the leading tenants in chief of lands held from the crown. The king himself presided over its deliberations, and its decisions were considered as final in judicial controversies, transfers of land, the granting or renewing monastic charters, in the imposition of extraordinary taxation, and in the determination of peace and war. In theory also it had the power of electing the king, and though as a rule the hereditary principle was maintained, an unworthy elder brother was sometimes set aside in favour of a more capable younger member of the royal family. With the Norman Conquest the Witenagemot was set aside in favour of a great council, composed of the bishops, abbots, earls, barons, and knights who held lands from the king, though it possessed but little real authority in comparison with the all but absolute rule of the monarch. After a time, however, the kings found it necessary to secure the support of the people, and they sought to obtain this by granting charters which promised good laws and justice, and by calling from time to time a council of the nation. These councils were not called with any regularity until the reign of Henry II., and during his reign their powers and functions were materially enlarged. Still greater progress was made during the reign of John, when, by the terms of the Great Charter, it was enacted that no scutage or aid, except the three regular feudal aids, should be imposed save by the common council of the realm. Another important provision of the charter was, that while the archbishop, bishops, abbots, earls, and greater barons were to be summoned personally by royal letters, the lesser barons, consisting of the knights and freeholders holding in chief of the crown, should also be summoned by a general writ through the sheriff. In reference to this, Mr. Freeman observes, "Here we have the beginning of our county members, and of the title which they still bear of knights of the shire. Here is the beginning of popular representation as distinct from the gathering of the people in their own person." Henry III. renewed the Great Charter in return

for a subsidy, and his reign is memorable in the history of Parliament as marking the origin of the present House of Commons. The shameful misgovernment of the king exasperated his subjects until they successfully rebelled against him, and under their leader, Simon de Montfort, earl of Leicester, the great medieval Cromwell, they made him a prisoner. In 1264 De Montfort caused writs to be issued summoning a national council, made up of the bishops, abbots, earls, and barons, together with two knights for each shire, two citizens for each city, and two burgesses for each borough. Whatever may have been the effect of this summons, we know that Edward I., the son and successor of Henry, in the twenty-third year of his reign, adopted this system of calling together knights, citizens, and burgesses as an easier way of raising money than the arbitrary measures of his predecessors, and fixed the meeting place at Westminster. The clergy persistently held aloof from this council, preferring to grant the subsidies demanded of them through the convocations of Canterbury and York, and for a considerable period after this the summons to the council was obeyed very unwillingly (or evaded) by the Commons. In spite of this the practice of calling the latter together at the same time and place, as part of the great council of the king, of necessity led to their obtaining a certain degree of political power. In 1297, the twenty-fifth year of Edward I., a statute was passed, which declared that "no tallage or aid should be taken or levied by us, or our heirs, in our realms, without the good-will and assent of the archbishops, bishops, earls, barons, knights, burgesses, and other freemen of the land." Thus the representative freeholders, or knights of the shires, were united with the representative citizens and burgesses in one assembly. In 1327, in the writs issued by Edward III. to the sheriffs to proclaim himself king, the knights, citizens, and burgesses are comprehended in the term Commons, as opposed to the prelates, barons, and other great men. The reign of Edward III. was marked by further advances in the power of Parliament, and the Commons claimed, their claim being admitted by the king, a veto upon all enactments affecting those great bodies of the people which they represented. They declared to the king in Parliament that they would not be compelled by any of his statutes or ordinances made without their consent. It was also in the reign of Edward III. that Parliament was formally separated into the two Houses of Lords and Commons, and that the deliberations were conducted in separate chambers. When the Commons became strong enough to exercise some control over all the great measures of government, the composition of this body became an object of solicitude to the crown. There could be no dispute as to the title of the counties to send their representatives to the national assembly, but that of the boroughs might be disputed, and close and nomination boroughs could be created at the royal pleasure. By the unscrupulous use of these powers the authority and independence of the Commons were greatly weakened by the king, and the process was further assisted by the action of the House itself, in narrowing the suffrage in the constituent bodies. The earliest measure of this kind is that of the eighth of Henry VI. (1430), which restricted the county franchise, formerly possessed by all freeholders, to those whose freeholds were worth clear 40s. a year, a sum at least equal to £20 of the present day. Hence for a period of 200 years, from the reign of Henry VI. to that of Elizabeth, though the form of the institution was retained it lost much of the influence it had formerly exercised upon the national policy. The reign of Elizabeth marked a revival of the independence of Parliament, and the queen, in spite of her imperious disposition, was repeatedly compelled to defer to the representatives of the nation. Under the reign of her successor, James I. the conflicts between the crown and the Commons became more serious, and matters

came to an issue when Charles I. ascended the throne. An account of this momentous struggle has already been given [see CHARLES I. and CROMWELL], and it will be sufficient here to note that the spirit of resistance to abuses of the royal prerogative, which displayed itself in the deposition and execution of Charles, was again manifested in the revolution of 1688, by which the supreme authority was transferred from the sovereign to Parliament. As Mr. Green observes, "From the moment when the sole right to tax the nation was established by the Bill of Rights, and where its own resolve settled the practice of granting none but annual supplies to the crown, the House of Commons became the supreme power in the state." The Triennial Act of 6 & 7 William and Mary, c. 7, deprived the crown of the power of continuing the same House of Commons for a longer period than three years, an enactment which had the effect, while it lasted, of favouring electoral freedom and parliamentary independence. In the reign of William III. were also passed, in compliance with public opinion, the several Acts which disqualify various classes of placemen for seats in the Commons' House.

The union with Scotland in 1707 (6 Anne, c. 8) added to the English, which then became the British House of Commons, thirty members for counties and fifteen for cities and boroughs, while the House of Lords was reinforced by the addition of sixteen peers representing the peerage of Scotland. Nearly a century later, by an Act of Parliament passed in 1800, which took effect from the 1st of January, 1801, the parliamentary representation of Ireland was incorporated with that of Great Britain. Sixty-four members for counties, thirty-five for cities and boroughs, and one member for Dublin University, were thus added to the British House of Commons, raising the number of members to 658. Twenty-eight representative peers, elected for life by the peerage of Ireland, were admitted to the House of Lords, and four Irish bishops were added to the lords spiritual. The latter were deprived of their seats in Parliament in 1869 on the disestablishment of the Church of Ireland.

The history of Parliament during the eighteenth century reveals the existence of an enormous amount of bribery and corruption. The theory of representation was maintained, but in reality it was but little more than an illusion. The county members were the nominees of the nobles and great landowners; the borough members were returned by the crown, by noble patrons, or by close corporations; while in the cities bribery was openly and shamelessly practised. Inside the House of Commons bribery was a recognized method of administration, and every man had his price. At the same time the influence of public opinion was powerful enough during the latter part of this period to keep Parliament in some accord with the general sentiment of the country. It seems, however, incredible that matters had gone on practically unaltered for close upon 600 years. Towards the close of the century several proposals were made for the reform of the constitution of the House of Commons, but it was not until 1832 that anything was accomplished. In that year, however, the pressure of public opinion operating upon the two houses, strengthened by the French Revolution of 1830, caused a complete reconstruction of the House of Commons to be effected by the Acts 2 Will. IV. c. 45 for England; 2 & 3 Will. IV. c. 65 for Scotland; and 2 & 3 Will. IV. c. 88 for Ireland. The changes under these Acts were very numerous, and they can hardly be enumerated in shorter terms than they are expressed in the Acts themselves. The number of county constituencies in England was increased from fifty-two to eighty-two by dividing many of the counties, and the number of county members was increased from 94 to 159. Fifty-six of the rotten boroughs of England and Wales were disfranchised; thirty boroughs had their right of sending two members reduced

to one; and two members were taken away from the four formerly sent by the united boroughs of Weymouth and Melcombe Regis. In all 133 members were taken away from these boroughs, and means were thus found for the enfranchisement of populous places. Twenty-two large towns, including metropolitan districts, became entitled to return two members, and twenty smaller towns acquired the right of returning one member each. In the boroughs a £10 household suffrage was substituted for the narrow and unequal franchises which had formerly prevailed, and in the counties the franchise was extended to all copyholders to the value of £10 a year, and to leaseholders for not less than twenty-one years with an annual rental of not less than £50. Among other great advantages secured by these Acts were—the division of counties and boroughs into more convenient polling districts, the shortening of the time of polling, and the registration of electors.

Although these alterations were of a sweeping character they yet left many glaring inequalities unaddressed, and the care taken not to disturb family interests effectually prevented anything like an equitable representation of the nation being effected. Bribery and corruption continued to prevail to a vast extent, and voters were exposed without protection to the coercion of landlords and employers of labour, while the great majority of the working classes were shut out from the franchise altogether. In consequence much dissatisfaction was felt by the more advanced Liberals with the state of popular representation, but it was not until some twenty years had elapsed that any serious agitation was commenced for an extension of the franchise and a redistribution of seats. From 1853 to 1866 several measures with these objects in view were submitted to the House of Commons by various ministers and private members without success; but at last, in 1867, on the suggestion of the Conservative government then in power, who saw that the question could no longer be delayed with safety, the House of Commons took the matter into its own hands, and made another great change in its constitution. The principal provisions of the measure then passed, with respect to England and Wales, were, that a representative should be taken from every borough with less than 10,000 inhabitants which had previously returned two; and that of the members thus obtained, together with others taken from places which had been totally disfranchised for bribery at the previous general election, nine should be given to new boroughs, each returning one member, twenty-nine to new divisions of large counties, and the remainder to large boroughs, which were either divided or had an additional member granted to them. By the same measure the franchise in boroughs was conferred on every ratepayer, and on all persons living in lodgings of the annual value of £10, if let unfurnished, and in counties on all persons rated to the poor at £12 per annum, the old 40s. freehold franchise being allowed to remain undisturbed. In the following year (1868) Acts to amend the representation of Scotland and Ireland were also passed. In the latter country no alteration whatever was made in the distribution of seats, but the borough franchise was reduced to a £4 rental. To Scotland seven additional members, obtained by totally disfranchising the seven smallest English boroughs, were given, and the franchise in boroughs was conferred on every ratepayer, as in England, and in counties on all persons occupying houses or lands of the annual value of £14.

The next parliamentary event of importance was the passing of the Ballot Act in 1872, by which it was enacted that all elections for members of Parliament should be by secret vote and ballot.

In 1884-85 a further important change was made in the representation of the country by the Franchise and Redistribution Bills introduced by the Liberal prime minister, W. E. Gladstone. By the first of these measures

the "ancient rights" franchises of the boroughs were left untouched; the household franchise of 1867 and the lodger franchise were undisturbed; the £10 clear yearly value franchise was extended to lands held without houses or buildings; and a new franchise, termed the "service franchise," was introduced for persons who were inhabitants of a house within the limits of the Act, but neither occupiers nor tenants. The borough franchises were thus divided into four kinds—the £10 franchise, the lodger franchise, the service franchise, and the household franchise of the Act of 1867. In respect to the counties the £50 franchise was abolished; the £12 ratable value franchise of 1867 was reduced to £10 yearly value; and more important still the service, lodger, and household franchises of the boroughs were imported also into the counties. Throughout the three kingdoms the borough and county franchises were thus placed on an identical footing. The Redistribution Bill, which, though introduced by the Liberal ministry, really represented the results of a compromise between the leaders of both parties, totally disfranchised all boroughs with a population up to 15,000, and reduced all towns with a population up to 50,000 to one member only. This principle was also applied to two counties, Rutlandshire and Herefordshire, from each of which one member was taken. By these provisions of the Act, 160 seats were extinguished, while six seats which had been extinguished since 1870 (Beverley two, Bridgewater two, Cashel one, and Sligo one) were revived. Of the seats thus made available, ninety-six were added to the counties, and new boroughs were created out of the counties, to which eight seats were allotted. Two members were taken from the city of London, but the metropolitan members were augmented by thirty-seven, while Liverpool received six additional members, Glasgow four, Birmingham four, Manchester three, Leeds two, and Sheffield three. With few exceptions the Act adopted the system of one-member districts. By the Reform Act of 1832 the number of members of the House of Commons was fixed at 658, and this number was again adhered to in 1867, but in 1885 the number was raised to 670, England returning 465, Wales 30, Scotland 72, and Ireland 103. At the time of passing the Act of 1885, allowing for the six extinguished seats, the House was made up of 283 county and 360 borough members, with 9 university members. By the new Act the number of county members was raised to 377, the number of borough members reduced to 284, and the university members were retained as before. Important as were these alterations perhaps the greatest change was in the increase of the number of electors. By the Act of 1832, it was expected that about 500,000 electors would be added to the constituencies, and the result showed that the number was overestimated. In 1867 about 1,300,000 new electors were added to the constituency of the three countries, but by the measure of 1885 more than 2,000,000 persons were enfranchised, raising the number of electors in the United Kingdom to about 5,000,000.

By the repeal of the Corporation and Test Acts in 1828, the passing of the Catholic Emancipation Act in 1829, and the removal of the words "on the true faith of a Christian" from the oath, most of the religious disqualifications which formerly existed were removed. Since 1868 the following is the form of oath taken by members:—"I ——— do swear that I will be faithful and bear true allegiance to Her Majesty Queen Victoria, her heirs, and successors, according to law. So help me God!" By special statute Quakers, Moravians, and Separatists are allowed to make affirmation, but this permission is limited to the persons named, all others being required to take the oath.

Constituent Parts of Parliament.—Parliament represents the king and the three estates of the realm. Of the king (or queen [see KING]) nothing need be repeated here.

Taking the year 1886 as an example we find that the House of Lords, exclusive of twelve minors, was then composed as follows:—

LORDS SPIRITUAL.	
Archbishops (York and Canterbury),	2
English Bishops,	24
Total,	
LORDS TEMPORAL.	
Princes of the Blood Royal,	5
Dukes,	21
Marquises,	19
Earls,	113
Viscounts,	28
Barons,	270
Representative Peers of Scotland,	16
Representative Peers of Ireland (elected for life),	28
Total,	

526

The original number has been greatly augmented from time to time, and there is no limitation of the power of the crown to add to it by further creations. The introduction of the representative peers of Scotland and Ireland was effected on the union of these kingdoms with England. The former are elected by the hereditary peers of Scotland descended from Scottish peers at the time of the Union, and sit for one Parliament only; the latter are chosen for life by the peers of Ireland, whether hereditary or created since the Union. The power of the crown to create Irish peers is limited by the Act of Union, so that one only can be created whenever three of the peerages of Ireland have become extinct. By a decision of the Court of Common Pleas in 1873, peers cannot vote for or in any way interfere with the election of members of Parliament.

Most peerages are now hereditary, but life peerages existed in early times. When in 1856 Sir James Parke was created Baron Wensleydale, "for and during the term of his natural life," it was found that law and usage precluded him from sitting or voting in Parliament, and he was therefore made an hereditary baron. In 1876, however, three lords of appeal in ordinary were constituted by statute, enjoying the rank of baron for life, and the right of sitting and voting in the House of Lords so long as they continue in office.

A member of the House of Commons cannot, in theory, resign his seat; but on the acceptance of any office of profit under the crown his election is void and a new writ ensues. Except in such cases as the acceptance of the stewardship of the Chiltern Hundreds [see CHILTERN HUNDREDS] the member who takes office is eligible for reelection. A first commission in the army or navy vacates a seat, but subsequent promotions do not do so.

POWER AND JURISDICTION OF PARLIAMENT.

1. *The Legislative Authority collectively.*—The authority of Parliament extends over the United Kingdom and all its colonies and possessions. There are no other limits to its power of making laws for the whole empire than those which are common to it and to all other sovereign authority, the willingness of the people to obey or their power to resist them.

Parliament does not, in the ordinary course, legislate directly for the colonies. For some, the queen in council legislates, and others have legislatures of their own, and propose laws for their internal government, subject to the approval of the queen in council; but these may afterwards be repealed or amended by Acts of Parliament. Their legislatures and their laws are both subordinate to the supreme power of the mother country. The constitution of Jamaica was suspended in 1866, and a provisional

government, with legislative functions and great executive powers, was established by the British Parliament.

2. Distribution of Powers between King, Lords, and Commons.—Custom and convenience have assigned to different branches of the legislature peculiar powers. The king swears at the coronation to govern "according to the statutes in Parliament agreed upon," and these, of course, may be altered. The sovereign is further bound to an adherence to the Protestant religion as established by law. By the Bill of Rights and Act of Settlement a person professing the Roman Catholic religion, or marrying a Roman Catholic, is incapable of inheriting the crown, and the people are absolved from their allegiance. The sovereign is also bound to maintain the Presbyterian form of church government in Scotland. Any prerogative of the crown may be taken away by the king, with the consent of the three estates of the realm. The king sends and receives ambassadors, enters into treaties with foreign powers, and declares war or peace, without the concurrence of Lords or Commons; but he cannot do these things without the advice of his ministers, who are responsible to Parliament.

Summons.—It is by the act of the king alone that Parliament can be assembled. There have been only two instances in which the Lords and Commons have met of their own authority—namely, previously to the restoration of King Charles II., and at the Revolution in 1688. But although the king may determine the period for calling Parliaments, his prerogative is restrained within certain limits, and he is bound by statute to issue writs within three years after the determination of any Parliament; and the practice of providing money for the public service by annual enactments renders it compulsory upon him to summon Parliament every year.

There is one contingency upon which the Parliament may meet without summons, under the authority of an Act of Parliament. It was provided by the 6 Anne, c. 7, "that in case there should be no Parliament in being at the time of the demise of the crown, then the last preceding Parliament should immediately convene and sit at Westminster." By the 37 Geo. III. c. 127, such Parliament can only sit for six months. The demise of the crown makes no difference in the life of the existing Parliament, but members have to be again sworn.

As the king appoints the time and place of meeting, so also at the commencement of every session he declares to both Houses the cause of summons by a speech delivered to them in the House of Lords by himself in person, or by commissioners appointed by him. Until he has done this neither House can proceed with any business.

If a new Parliament is to be elected the chancellor sends his warrant to the clerk of the crown in Chancery; the latter issues writs to the sheriff to procure the election of knights and burgesses. On a vacancy occurring whilst Parliament is sitting, a writ for the election of a new member is issued after motion in the House. If the vacancy occur during prorogation, and it be occasioned by death, the writ is issued at the instance of the Speaker.

Prorogation and Adjournment.—The sovereign may prorogue Parliament by having his command signified in his presence by the Lord Chancellor or Speaker of the House of Lords to both houses, or by writ under the great seal, or by commission. The effect of a prorogation is to suspend all business until Parliament may be summoned again. It has become customary of late for Parliaments to meet in February, the session extending to August in each year. Every session must end with a prorogation, and by it all bills which have not been brought to a conclusion fall to the ground. Both houses of legislature must be prorogued at the same time; but before this can be done one bill at least must have become an "Act of Parliament." The prorogation takes place either by the sovereign in person, or by commission from the crown, or by proclamation.

The lower House appears at the bar, and if the sovereign be not present the Speaker reports upon the labours of the session: the royal assent is then given to bills of the closing session, and a speech from the sovereign is then read, thereupon the Lord Chancellor prorogues the Parliament to a certain day. Not only are the sittings of Parliament at an end, but all proceedings pending at the time, except impeachments by the Commons, special commissions, and committees authorized by the House to continue sitting, are quashed. A bill must be renewed after a prorogation as if it had never been introduced, though the prorogation be for no more than a day. There has been some exception recently allowed with respect to private bills, and with the increasing pressure of the business of Parliament it is probable that the rule will be still further modified.

Adjournment is solely in the power of each House respectively.

Dissolution.—The sovereign may put an end to the existence of Parliament by a dissolution; but after seven years it ceases to exist under the statute of George I., commonly known as the Septennial Act. Before the Triennial Act, 6 Will. and Mary, there was no limit to the continuance of a Parliament, except the will of the king. Parliament is dissolved by proclamation, after having been prorogued to a certain day.

Special Privileges of the House of Lords.—The judicial functions of the Lords, and their power to pass bills affecting the peerage, which the Commons may not amend, are the only properties peculiar to them, apart from their personal privileges.

Taxation.—The chief powers vested solely in the House of Commons are those of imposing taxes and voting money for the public service. Bills for these purposes can only originate in that House, and the Lords may not make any alterations in them, except for the correction of clerical errors. On the opening of Parliament the king directs estimates to be laid before the House, but the amount may be varied by the Commons at pleasure. Grants distinct from those proposed in the estimates cannot be made without the king's recommendation being signified.

Right of determining Elections.—The Commons formerly determined all matters touching elections, but the duty of investigating election petitions is now deputed to judges, who carry on their inquiry on the spot.

Oaths.—The power of administering oaths exercised by the Lords is not claimed by the House of Commons. Witnesses guilty of falsehood there are punished as for a breach of privilege. Judges investigating election petitions have power to administer oaths, and witnesses who give false evidence before them are guilty of perjury.

3. Privileges.—Both Houses of Parliament possess various powers and privileges for the maintenance of their authority, and for the protection, convenience, and dignity of individual members, some of which have been enjoyed for hundreds of years.

By resolutions passed many years since, it was declared to be "an indignity and a breach of privilege" to publish the debates of either House, but this rule has been in abeyance since 1771, and suitable accommodation has long been provided for reporters. A gallery is also provided in the House of Commons for distinguished persons, ambassadors, and other "strangers" who obtain from the Speaker or from a member an order for admission. Up to the session of 1875, however, reporters and all other non-members might be excluded by any single member who chose to call the Speaker's attention to the fact of there being "strangers" in the House. This took place twice in 1870, and again in 1872, though no member had exercised such a privilege before for thirty years. In 1875 the extent to which this privilege was abused led to a resolution by which the exclusion of strangers is now only possible by decision of the House, or at the will of the Speaker. No strangers

other than the reporters are allowed either to read, write, or even take written notes in the House. Publication of evidence taken before a select committee previous to its being reported, is punishable as a breach of privilege. Libellous reflections on the character and proceedings of Parliament, or of individual members, as such, come under the same category, as does also assaulting or threatening a member. Willful disobedience to the orders of the House is likewise punishable as a breach of privilege; the offer of a bribe to, or its acceptance by, a member is liable to be treated in the same manner, as is also any interference with the officers of the House in the execution of their duty, or tampering with witnesses who are to be examined by the House or a committee.

Commitment and Fines.—The power of commitment for contempt has always been exercised by both houses. Breaches of privilege committed in one session may be punished by commitment in another, as in the well-known case of Murray, in 1751–52, who was imprisoned in Newgate for a libel until the end of the session, and on the next meeting of Parliament was again ordered to be committed; but he had absconded in the meanwhile. A still better-remembered case is that of Mr. Grissell, who avoided arrest during the session of 1879 by making off to France under plea of ill health; but who, on the first opportunity after Parliament commenced sitting in 1880, was promptly arrested by the sergeant-at-arms, and confined in Newgate to the close of the session. Contempts of a former Parliament may also be punished. The Lords may commit for a definite period beyond the duration of the session; but a commitment by the Commons is not for any special period, and may continue only until the close of the session.

The House of Lords, in addition to the power of commitment, may impose fines. This privilege is not now exercised by the Commons, though it was formerly.

Freedom of Speech.—Freedom of speech is one of the privileges claimed by the Speaker on behalf of the Commons, and it is one that has long been confirmed as the right of both Houses of Parliament by statutes. The most solemn recognition of the privilege is contained in the Bill of Rights, which declares "that the freedom of speech and debates and proceedings in Parliament ought not to be impeached or questioned in any court or place out of Parliament." But if a member publish his speech, and it contain libellous matter, he is not protected by the privilege of Parliament.

Freedom from Arrest.—The Speaker's petition prays, on behalf of the Commons, "that their persons, *their estates*, and *servants*, may be free from arrest and all molestations." This privilege, however, formerly largely availed of, has been limited by statutes. The persons of members are still free from arrest or imprisonment in civil actions, but their property is as liable to the legal claims of all persons as that of any private individual. Their servants no longer enjoy any privilege or immunity. The privilege of freedom from arrest has always been subject to the exception of cases of "treason, felony, and surety of the peace;" and though in other criminal charges each House may, if it see fit, prevent the abstraction of a member from his parliamentary duties, it is very seldom that the protection has been granted. Peers and Lords of Parliament are always free from arrest on civil process; and as regards the Commons, their privilege is supposed to exist for forty days after every prorogation and forty days before the next appointed meeting.

Jurisdiction of Courts of Law in Matters of Privilege.—In connection with the exercise of privilege, an important point of law arises as to the jurisdiction of courts of justice. Each House of Parliament is acknowledged to be the judge of its own privileges; and the degree of jurisdiction to be exercised by the courts, and the proper mode of dealing with actions involving matters of privilege, are

difficult to determine, after the inconsistencies which have appeared in practice, and the great variety of opinions expressed by learned men.

FORMS OF PROCEDURE.

Meeting of Parliament: Preliminary Proceedings.—

On the meeting of a new Parliament it is the practice for the lord chancellor, with other peers appointed by commission under the great seal for that purpose, to open the Parliament by stating "that His Majesty will, as soon as the members of both Houses shall be sworn, declare the causes of his calling this Parliament; and it being necessary a Speaker of the House of Commons should be first chosen, that you, gentlemen of the House of Commons, repair to the place where you are to sit, and there proceed to the appointment of some proper person to be your Speaker; and that you present such person whom you shall so choose here to-morrow (at an hour stated), for his Majesty's royal approbation." The Commons then proceed to the election of their Speaker.

When the Speaker has been approved by the crown, which is now a matter of form, he lays claim on behalf of the Commons, "by humble petition, to all their ancient and undoubted rights and privileges," which being confirmed, the Speaker with the Commons retires from the bar of the House of Lords. Both Houses then take the oaths required by law. Three or four days are usually occupied in this duty, after which the causes of summons are declared by the sovereign in person, or by commission in "the king's (or queen's) speech." The first thing usually done in both Houses is to vote an address in answer to the speech from the throne.

After this the real business of the session commences, the committees of supply and ways and means are set up, bills are introduced, motions are made, committees are appointed, and both Houses are at once in full activity. The Lord Chancellor presides over the deliberations of the Lords, and the Speaker over those of the Commons. In the sittings, before any business is undertaken, prayers are read in the House of Lords by a bishop, and in the Commons by their chaplain. Any member in the Commons having secured a seat at prayers is entitled to retain the same for that sitting, until the rising of the House, but no member's name can be affixed to any seat before the hour of prayers.

Conduct of Business, Divisions, &c.—In the House of Lords business may proceed when three peers are present. In the House of Commons forty members are required. If that number be not present at four o'clock in the afternoon, or if notice be taken, or if it appear on a division that less than that number are present, the Speaker adjourns the House till the next sitting day; but at the morning sittings, which are held on Wednesdays, twenty members are sufficient, and on that day they sit from twelve at noon till six, unless previously adjourned. Towards the end of the session morning sittings are also held on other days for the expedition of necessary business. Precisely at six o'clock on Wednesdays the Speaker adjourns the House without putting the question, and the business in hand stands as an order of the day for the next sitting. In the Commons no one can vote who is not present when the question is put; and although up to 1868 proxies could be taken in the Lords, and may even still if a majority of the House so decide, after due notice, the principle is now virtually abandoned, and it is very doubtful whether they will ever be employed again. In the Lords the party in favour of the question before the House are called "content," and that opposed to it "non-content." In the Commons these parties are described as "ayes" and "noes." When the Speaker cannot decide by the voices which side has the majority, or when his decision is disputed, a division takes place. This is effected by one party being sent to each of

the two lobbies attached to either House—the “ayes” to the right and the “noes” to the left. All within the House when the question is put must vote. Two clerks are stationed at each of the entrances to the House, holding lists of the members printed in alphabetical order on large sheets of pasteboard, so as to avoid the trouble and delay of turning over pages. While the members are passing into the House again the clerks put a mark against each of their names, and the tellers count the number. Since its adoption this plan has proved quite successful: the names are taken down with great accuracy, and comparatively little delay is occasioned by the process. The Speaker of the House of Commons, who does not otherwise vote or take part in a debate, has a casting vote in case of equality. In the House of Lords, on the other hand, the lord chancellor is not disqualified from taking part in a debate and voting, but he has no casting vote, and in case of equality the non contents prevail. The system of pairing, so commonly practised, though never directly recognized by Parliament, enables members on opposite sides to absent themselves for a time agreed on, each neutralizing the votes of the other. A “call of the House” is an expedient to secure attendance in the Commons on very important occasions, but it is rarely resorted to. When it is made members absent without leave may be taken into custody. The same plan, if adopted in the House of Lords, is called a “summons.” In addition to the power of expressing assent or dissent by a vote, peers may record their opinion and the grounds of it by a “protest,” which is entered in the journals, together with the names of all the peers who concur in it.

Members claim to be heard in debate by rising in their places. When more than one member rises at the same time, in the Lords the member who is to speak is called by the House, in the Commons by the Speaker. It is presumed in the House of Commons that the preference is given by the Speaker to the member who is rising “first caught his eye,” though it is recognized that this is not always a true test, inasmuch as he cannot see all the members at once, and may not really know which rose first. In debate a member of the Commons addresses the Speaker or the chairman of the committee, but in the House of Lords the Lords generally, in both cases standing and uncovered. No allusion is allowed to debates of the same session on a question not under discussion, or to debates in the other House of Parliament. All reflections on any determination of the House are prohibited, except when made with a view of moving that the determination be rescinded; so is the mention by a member of the name of the sovereign, either irreverently, or to influence the debate, and the use of offensive and insulting words against Parliament, or either House, or against a member of the House which the debater is addressing. No member must be referred to by name, or otherwise than by the rank or office which he enjoys, or the place he represents.

Obstruction of the Business of the House.—In regulating the procedure of the House of Commons in the past, the objects chiefly aimed at by the members have been to secure themselves against undue pressure on the part of the crown or the ministry, and to insure for every measure brought forward full publicity and adequate discussion. In framing the rules for the conduct of business, it was always assumed that they were for the guidance of men who desired to maintain the honour and dignity of the assembly, and to maintain for the House its high position in the government of the empire. During the past decade, however, a new feature has been introduced into parliamentary life by the advent of a party, the members of which openly avowed their hostility to the House of which they formed part, and who endeavoured to obtain their ends, and to bring the House itself into contempt, by the systematic and persistent obstruction of both public and private business. In using this weapon of obstruction all the

forms of the House designed for the protection of the rights of its members were utilized to hinder the transaction of any business, and it was discovered that by a skilful use of these forms, a small minority of determined obstructionists could keep within the letter of the law, and yet bring public business to a complete standstill. In 1881 a deadlock was only prevented by the irregular action of the Speaker, and the following year some new rules were introduced and accepted, by which it was hoped that obstruction for obstruction's sake would in future be rendered impossible. The most important of these rules was the first, generally known as the “Closure Rule,” by which it was enacted that “When it shall appear to Mr. Speaker, or to the Chairman of Ways and Means in a Committee of the whole House, during any debate, that the subject has been adequately discussed, and that it is the evident sense of the House, or of the Committee, that the question be now put, he may so inform the House or the Committee; and if a motion be made ‘That the question be now put,’ Mr. Speaker or the Chairman shall forthwith put such question; and if the same be decided in the affirmative, the question under discussion shall be put forthwith, provided ‘That the question be now put’ shall not be decided in the affirmative, if a division be taken, unless it shall appear to have been supported by more than 200 members, or unless it shall appear to have been opposed by less than forty members and supported by more than 100 members.” The other rules, to the number of twelve, were designed to prevent certain forms of the House being used for the obstruction of business, and for the maintenance of order and decorum in its proceedings. Upon the whole the new rules have worked well, and they have prevented the free use of some of the methods of obstruction formerly practised without hindrance; but experience has shown that even as thus amended, the forms of the House still afford many opportunities for the wilful hindrance of its business, and a select committee to inquire into and report on the whole question of procedure was appointed in 1886.

Bills, Public and Private.—Bills are divided into two classes—such as are of a public nature, affecting the general interests of the state, and such as relate only to local or private matters. The former are introduced directly by members; the latter are brought in upon petitions from the parties interested, after the necessary notices have been given and all forms required by the standing orders have been complied with.

With few exceptions, public bills may originate in either House, unless they be for granting supplies of any kind, or involve directly or indirectly the levying or appropriation of any tax or fine upon the people. The exclusive right of the Commons to deal with all legislation of this nature affects very extensively the practice of introducing private bills into either House. Thus, all those which authorize the levying of local tolls or rates were formerly brought in upon petition to the Lower House. These compose by far the greater part of all private bills. All measures of local improvement, whether for inclosing land, lighting, watching, and improving towns, establishing police, or making roads, bridges, railways, canals, or other public works, also formerly originated in the Commons; but in consequence of the pressure of business in recent years, some private bills involving local taxation have been allowed to be first introduced into the House of Lords. The practice was commenced in 1860. No bill relating either to religion or trade can be brought into the House of Commons until the proposition has first been considered and agreed to in a committee of the whole House. Acts of grace must originate with the crown, where the prerogative of mercy is vested.

Progress of Bills: Public Bills.—In the House of Lords any member may present a bill; and in the Commons motions for leave to bring in bills of a public nature are

not very frequently refused. The more usual time for opposing any measure in its progress is on the second reading, when all the provisions are known, and the general principle and effect of them may be considered. When leave is given to bring in a bill, certain members are ordered to prepare it, who are the proposer and seconder of the motion, to whom others are sometimes added. It is then brought in and read a first time, and a day is fixed for the second reading, which generally leaves a sufficient interval for the printing and circulation of the bill. The whole bill is not of course actually read, but merely its title.

The second reading is the occasion on which a bill is more particularly discussed. Its principle is at that time made the subject of discussion, and if it meet with approval, the bill is committed, either to a committee of the whole House or to a select committee, to consider its several provisions in detail. A committee of the whole House is in fact the House itself, in the absence of the Speaker from the chair; but the rule which allows members to speak as often as they think fit, instead of restricting them to a single speech, as at other times, affords great facilities for the careful examination and full discussion of details. The Speaker may address the House and vote as an ordinary member in committee, but the privilege is scarcely ever exercised. The practice of referring bills of an intricate and technical description to select committees has become very prevalent of late years. Many bills are understood by a few members only, whose observations are listened to with impatience, and thus valuable suggestions are often withheld in the House, which in a committee might be embodied in the bill. By leaving such bills to a select committee, the House is enabled to attend to measures more generally interesting, while other business, of perhaps equal importance, is proceeding at the same time; and it has always the opportunity of revising amendments introduced by the committee. In 1882 a further experiment was tried in the appointment of two standing committees, specially constituted, to whom bills relating to law, courts of justice, and legal procedure, and to trade, shipping, and manufactures, might be committed, instead of to a committee of the whole House. It was found that this alteration of procedure afforded great relief to the House and enabled it to get through an amount of business that would have been impossible under ordinary methods, and it is not unlikely that the scheme of grand committees will be considerably developed in future. The Commons have standing orders for insuring the efficiency of committees and impartiality in their appointment. Select committees do not usually consist of more than fifteen members, but the number of the two grand committees was fixed at not less than sixty nor more than eighty. Except where leave of absence has been obtained, no member can excuse himself from serving on a committee to which he may be appointed.

Before a bill goes into committee there are certain blanks for dates, amount of penalties, &c., which are filled up in this stage. Bills of importance are often recommended, or in other words, pass twice, and even in some instances three or four times, through the committee. When the proceedings in committee are terminated, the bill is reported with the amendments to the House, on which occasion they are agreed to, amended, or disagreed to, as the case may be. If many amendments have been made, it is a common and very useful practice to reprint the bill before the report is taken into consideration. After the report has been agreed to, the bill with the amendments is ordered to be engrossed previous to the third reading. A proposition was recently made, but without success, for discontinuing the custom of engrossment upon parchment, and for using an examined copy of the printed bill, signed by the clerk of the House, for all the purposes for which the engrossed copy is now required.

The third reading is a stage of great importance, in which the entire measure is reviewed, and the House determines whether, after the amendments that have been made in previous stages, it is fit on the whole to pass and become law. The question, "that this bill do pass," which immediately succeeds the third reading, is usually no more than a form, but there have been occasions on which that question has been opposed, and even negatived. The title of the bill is settled last of all.

An interval of some days usually elapses between each of the principal stages of a bill; but when there is any particular cause for haste, and there is no opposition, these delays are dispensed with, and the bill is allowed to pass through several stages, and occasionally through all, on the same day.

This statement of the progress of bills applies equally to both Houses of Parliament. There is, however, a slight distinction in the title of a bill while pending in the Lords, which is always entitled "an Act," whether it has originated in the Lords or has been brought up from the Commons.

No bill is allowed to be introduced into either House substantially the same as one on which the judgment of that House has been expressed during the current session. A resolution of the House may, however, be rescinded; and a bill already passed may be altered, amended, and repealed in the same session. The most common method of throwing out a bill on the second reading is to move that it be read that day six months—that is, at a time when the House will not be sitting.

When the Commons have passed a bill they send it to the Lords. Formerly it was forwarded by one of their own members, who was usually accompanied by not less than eight other members. The Lords sent down bills by two masters in chancery unless they related to the crown or the royal family, in which case they were generally sent by two judges. According to a new arrangement, made in 1855, one of the clerks of either House may be the bearer.

Private Bills.—In deliberating upon private bills Parliament may be considered as acting judicially as well as in its legislative capacity. The conflicting interests of private parties, the rights of individuals, and the protection of the public have to be reconciled. Care must be taken, in furthering an apparently useful object, that injustice be not done to individuals, although the public may derive advantage from it. Vigilance and caution should be exercised, lest parties professing to have the public interests in view should be establishing, under the protection of a statute, an injurious monopoly. The rights of landowners among themselves, and of the poor, must be scrutinized in passing an inclosure bill. Every description of interest is affected by the making of a railway. Land, houses, parks, and pleasure-grounds are sacrificed to the superior claim of public utility over private rights. The repugnance of some proprietors to permit the line to approach their estates, the eagerness of others to share in the bounty of the company and to receive more than the value of their land, embarrass the decision of Parliament as to the real merits of the undertaking, which would be sufficiently difficult without such contentions. If a company receive authority to disturb the rights of persons not interested in their works, it is indispensable that ample security be taken that they are able to complete them so as to attain that public utility which alone justified the powers being intrusted to them. The imprudence of speculators is to be restrained, and unprofitable adventures discouraged, or directed into channels of usefulness and profit. In short, Parliament must be the umpire between all parties, and endeavour to reconcile all interests.

The inquiries that are necessary to be conducted in order to determine upon the merits of private bills are too ex-

tensive for the House to undertake, and it has therefore been usual to delegate them to committees. To prevent parties from being taken by surprise, the standing orders require certain notices to be given (to the public by advertisement, and to parties interested by personal service) of the intention to petition Parliament. The first thing which is done by the Commons on receiving the petition, therefore, is to inquire whether those notices have been properly given, and if all other forms prescribed by the standing orders have been observed. This inquiry is confided to a committee, who report their determination to the House; and if it be favourable, leave is given to bring in the bill.

Petitions.—Among the other duties of Parliament is that of receiving PETITIONS.

Conferences between the two Houses.—When a bill has been returned by either House to the other, with amendments which are disagreed to, a conference is desired by the House which disagrees to the amendments to acquaint the other with the reason for such disagreement, in order, to use the words of Hatsell, "that after considering those reasons, the House may be induced, either not to insist upon their amendments, or may, in their turn, assign such arguments for having made them as may prevail upon the other House to agree to them."

Royal Assent to Bills.—The form of giving the royal assent to bills has already been described. See ASSENT, ROYAL.

Impeachment.—Impeachment by the Commons is a proceeding of great importance, involving the exercise of the highest judicial powers by Parliament, and though in modern times it has rarely been resorted to, in former periods of our history it was of frequent occurrence. The earliest instance of impeachment by the Commons at the bar of the House of Lords was in the reign of Edward III. (1376). Before that time the Lords appear to have tried both peers and commons for great public offences, but not upon complaints addressed to them by the Commons. During the next four reigns cases of regular impeachment were frequent, but no instances occurred in the reigns of Edward IV., Henry VII., Henry VIII., Edward VI., Queen Mary, or Queen Elizabeth. The institution "had fallen into disuse," says Mr. Hallam, "partly from the loss of that control which the Commons had obtained under Richard II. and the Lancastrian kings, and partly from the preference the Tudor princes had given to bills of attainder or of pains and penalties, when they wished to turn the arm of Parliament against an obnoxious subject." Prosecutions, also, in the Star-chamber during that time were perpetually resorted to by the crown for the punishment of state offenders. In the reign of James I. the practice of impeachment was revived, and was used with great energy by the Commons, both as an instrument of popular power and for the furtherance of public justice. Between the year 1620, when Sir Giles Mombtressor and Lord Bacon were impeached and the Revolution in 1688, there are about forty cases of impeachment. In the reigns of William III., Anne, and George I., there were fifteen, and in George II. only one (that of Lord Lovat, in 1746, for high treason). The last memorable cases are those of Warren Hastings in 1788, and Lord Melville in 1805.

Expenses of Parliament.—The annual expenses of Parliament amount to rather more than £160,000, of which nearly one-half is expended in printing. The House of Lords furnishes no detailed statement of the staff employed, for they are all paid out of a fee-fund which is managed by the House itself, and does not appear in the public accounts, with the exception of the chairman of committees, who has £2500 per annum; his counsel, who has £1500; and the sergeant-at-arms, whose salary is £1500. The principal functionary of the House of Commons is the Speaker, who is elected at the commencement of every Parliament. He has a salary of £5000 a year, and a hand-

some official residence. The chairman of committees of the whole House is also elected by the members at the opening of each Parliament. He enjoys a salary of £1500 per annum. The clerk of the House of Commons is appointed for life by letters patent from the crown. He has a salary of £2000 a year and an official residence. His duty is to keep the journals of the House, and take the general charge of its official business. The duties of the sergeant-at-arms are to preserve order, and to arrest and keep in custody all persons committed to his charge by warrant from the House. His salary is £1200 per annum. Each of these officers has the appointment of various clerks and officers, many of whom have very handsome salaries. The counsel to the Speaker has £1500; the principal clerk-assistant, £1750; the second clerk, £1250; the chief librarian, £1000; the deputy sergeant-at-arms, £800; assistant, £500; principal door-keeper, £300.

The best work of reference on Parliament is "A Treatise upon the Law, Privileges, Proceedings, and Usage of Parliament," by Sir Thomas Erskine May.

Names of Parliaments.—Many Parliaments have earned nicknames: the following list embraces the chief examples.

The *Mad Parliament* met at Oxford, 1258, reasserted Magna Carta, and passed the provisions of Oxford under the leadership of Simon de Montfort. The nickname was given it by the king's party (Henry III.).

The *Model Parliament* of 1295 was so called as being the first complete model of our parliamentary system.

The *Good Parliament* sat under Edward III. in 1376, and received its honourable title from its earnest attempt to cope with the abuses of the time. The Black Prince supported its praiseworthy efforts, but his death and the consequent return of John of Gaunt to power rendered them ineffectual.

The *Merciless Parliament* was a nickname applied to the reforming Parliament of 1388 by the king's party (Richard II.); in it the lords appellants ruled supreme, and many of the king's evil advisers were put to death.

The *Unlearned or Illiterate Parliament* contained no lawyers. Henry IV. in convening it at Coventry in 1401 made this peculiar exception.

The *Bat Parliament* of 1425 was notorious for the bats (clubs) constantly carried, and not unfrequently used, by the fierce partisans of Gloucester and Bedford, the rival uncles of the boy king, Henry VI.

The *Devil's Parliament* was convened by Henry VI. at Coventry in 1459, and gained its name at the hands of the Yorkists by its wholesale attainder of their party.

The *Reformation Parliament* of 1529, substituted royal for papal supremacy, and practically established the Church of England.

The *Added Parliament* was the derisory title earned at court by the second Parliament of James I., which passed no bill, though it sat for two months, 5th April to 7th June, 1614. Nearly all the court candidates had been rejected, and the "country party," i.e. the opposition, was in overwhelming force. Pym, Eliot, Wentworth, and many others to take part presently in the greater struggle, were members of it. James was so worried at every point that he sent four members to the Tower and dissolved the Parliament. He governed illegally without a Parliament for seven years rather than summon another such fierce body of remonstrants and malcontents.

The *Useless Parliament* was another royal nickname, given by King Charles' friends to the Parliament of London and Oxford, June to August, 1625; "useless" except to exasperate the new monarch by its refusal to permit the illegal exactions of the Stuart dynasty to continue.

The *Short Parliament* was that which sat from 13th April to 5th May, 1640, refusing to grant supplies till the sore grievances of the kingdom were redressed. Charles I.

dissolved it in three weeks, and summoned Strafford (Wentworth) from Ireland to oppose the disaffected kingdom by arms.

The *Long Parliament*, summoned in November, 1640, under the pressure of a Scotch armed advance, sat till 1660, nominally, but till 1653 actually. Cromwell "purged" it by means of Colonel Pride and his soldiers in December, 1648. In December, 1659, it was called together by its old Speaker Lenthall, in its complete form, as being the last Parliament summoned by a king, and therefore the only legal body in the kingdom in the eyes of the royalists able to make arrangements for the restoration of the monarchy. It summoned a new Parliament on its own authority, February, 1660, and then dissolved itself.

The *Rump Parliament* was the rump or remainder of the Long Parliament left after "Pride's purge" had freed it from 110 royalist members obnoxious to the republican majority, in December, 1648. It was forcibly ejected by Cromwell, 19th April, 1653, while in the act of practically voting its own perpetual existence; for it was straining the forms of the House to rush a bill through calling a new Parliament, of which all present should be *de facto* members, and moreover should have the right to revise the elections, rejecting such new members as were not deemed fit. Cromwell and the army demanded a new Parliament without any such provisos.

The *Barbours Parliament*, also called the *Little Parliament*, was called by Cromwell in July, 1653, its 156 members being chosen from a list sent in by the various churches to Cromwell and his council of state. Its title was derived from the peculiar name of one of the members for London, Mr. Præsegod Barboure, a leather merchant. It was strictly a constituent assembly, convened not as a Parliament, but as a means for summoning a Parliament. As, however, it at once assumed parliamentary duties and powers, it awakened a profound distrust not only among the people at large, but also among the council itself. Eventually, the assembly felt that it was effecting no useful purpose, and resigned its powers in December.

The *First Convention Parliament* (so called as not being summoned by the king himself) was that summoned by the resuscitated Long Parliament, and met 25th April, 1660. It voted the restoration, abolished feudal tenures, created the excise, and settled the many disputed points of property, &c., arising out of the revolution, for the most part with fair wisdom and discretion. This done Charles dissolved it 29th September, 1660.

The *Drunken Parliament*, 1661-79, received its name from the roystering cavaliers who formed its majority; it was also called the *Cavalier Parliament*, and a third name was the *Pensioners Parliament*, since a good half of its members were in the pay of either France or Spain. Pepys, an excellent judge, as while he was a thorough king's-man he was also a man of decent life, says of this Cavalier Parliament of 1661, "They are the most profane swearing fellows that ever I heard in my life." There were not more than fifty of the old Presbyterian party left in the House. This Parliament, which sat for eighteen years, is, accurately speaking, the longest-lived of all our Parliaments.

The *Second Convention Parliament* was that which met after the abdication of James II., 23rd December, 1688, had left the country without a government. It was summoned by a body of two Houses—namely, the entire House of Peers and a House of Commons formed of all members of the Commons elected for any Parliament under Charles II., and of the lord mayor, aldermen, and common council of London. This composite body requested William, prince of Orange, to take on himself the temporary government of the realm, and to issue circular letters of election to every county and borough, for the election of a Convention Parliament, which was done. The Convention met in January, 1689, and conferred the crown on William and Mary;

it then converted itself into a Parliament by a bill passed in the usual way, which received the royal assent 23rd February, 1689. But several members of the Opposition retired from what they deemed an illegal Parliament. The Second Convention Parliament sat till 6th February, 1690, when the king dissolved it.

It only remains to give a short list of the most important dates in our parliamentary history affecting the constitution, powers, and rights of Parliament.

1213. Knights of shire first summoned to the National Council, August.

1261. Burgesses first summoned, December; met January, 1265.

1295. First complete representation in the "Model" Parliament.

1297. *Confirmatio cartarum*; consent of Parliament necessary to taxation.

1322. Commons assert their right to legislative authority.

1333. First division into two Houses.

1353. First instance of appropriation of supplies (not finally established till 1665).

1376. First instance of impeachment.

1406. Right of supervising public accounts finally admitted.

1407. Right of Commons to originate money bills admitted.

1430. Limitation of the County Franchise to 40s. freeholders.

1539. Dissolution of monasteries, and consequent disappearance of abbots from House of Lords; also king's proclamation to have the force of law—repealed 1547.

1604. Right of Commons to control their own elections established.

1621. The Great Protest.

1628. Petition of Right, November.

1641. Grand Remonstrance, November.

1641. Triennial Act—that a Parliament must be summoned within three years of its last meeting; repealed 1661.

1649. Abolition of House of Lords; restored 1660.

1657. Cromwell's "House of Lords."

1689. Bill of Rights.

1694. Triennial Act, limiting the duration of a Parliament to three years.

1701. Act of Settlement.

1708. Act against pensioners and placemen. Members accepting office under the crown required to vacate their seats, and (if they chose) to offer themselves for re-election.

1716. Septennial Act, extending duration of Parliament to seven years.

1719. Peerage Bill, the crown not allowed to increase the existing number of 178 peers by more than six, thrown out by Commons.

1762. Bribery Act. Subsequent Acts, 1842, 1852, 1851, 1858, &c.

1832. The great Reform Act.

1854. Corrupt Practices Act.

1867. Reform Act. Household Suffrage in boroughs.

1872. Ballot Act.

1885. Reform Act. Household Suffrage in counties.

PARMA, a walled town of Italy, the capital of the province of the same name, situated in a fine plain about 12 miles south from the Po, on the railway between Modena and Piacenza, 75 miles south-east of Milan, and divided into two parts by the ancient *Via Emilia*. Its elevation above the sea is 162 feet, and the temperature ranges from 88°, greatest heat, to 21°, greatest cold. The city is of a circular form, entered by fine gates, and has a glacis forming a public promenade. It is a bishop's see, and had 45,217 inhabitants in 1882. The University of Parma was suppressed in 1831, but it still has a school of four faculties, besides

a military college, grammar-school, and a school for the arts, &c. There is a public library containing 200,000 volumes, a museum of antiquities, and a gallery of paintings, which are all valuable collections.

Most of the churches of Parma are adorned with paintings by Correggio. The most remarkable are—the cathedral; the baptistery, which is built of marble and adorned with numerous statues and frescoes; St. John the Evangelist; L'Annunziata; and la Madonna della Steccata, which contains the tombs of the dukes of Parma, among others that of Alessandro Farnese. Parma has many charitable institutions, and in the vicinity are elegant villas. There is a school for deaf mutes, civil and military hospitals, a botanic garden, numerous scientific establishments, an academy of fine arts, &c. Among other noticeable public buildings may be mentioned the palace, a benedictine monastery, Farnese Palace, and a theatre.

The manufactures are cloaks, felt hats, stockings, porcelain, sugar, wax candles, and vessels of crystal; also silk, cotton, and fusian stuffs. Parmesan cheese is still made, but it is poor in quality.

Parma was made a Roman colony at the same time as Mutina (Modena), B.C. 183. After the fall of the Western Empire it was subject successively to the Goths, the Longobards, and the Carolingians, and afterwards governed itself, for a time, as a republic. Subsequently it was possessed in succession by the Visconti of Milan, and by Can della Scala, lord of Verona, after whose death the citizens placed themselves under the supremacy of the Pope; but in 1334 the family of Correggio drove away the papal governor and took possession of the government. It next passed again under the dominion of the Visconti, and then came under the Sforza, dukes of Milan. For three or four centuries the dukes of Parma were feudatories alternately of the popes, the kings of France, and the emperors of Germany; and the dukedom was a fertile subject of strife and contention. Even down to the time of Bonaparte's invasion of Italy these contested claims were urged. Parma was under the yoke of France from 1796 till 1814, in which year the Congress of Vienna decided that the duchy of Parma and Piacenza should be the appanage of Napoleon's wife, Maria Louisa of Austria, during her lifetime; that the ex-queen of Etruria and her son should have the duchy of Lucca; and that after the death of Maria Louisa of Austria the Duke of Lucca should be restored to his paternal states of Parma. In 1860 the duchy was annexed to the kingdom of Italy.

PARMELIA is a genus of foliaceous LICHENS, several species of which are very common in Great Britain, and used to be employed medicinally or in dyeing. *Parmelia parietina* is the common yellow wall-moss, to which important tonic and febrifugal properties have been ascribed. *Parmelia perlata* is a dyewood. *Parietia*, a chemical principle, has been discovered in the members of this extensive genus.

PARMENIDES, of Elea, was by far the most important of that great Greek school of philosophy to which perhaps Sokrates, and hence Plato, owed more than to any other. The Eleatics taught the essential unity of God in nature—Xenophanes, the eldest of them treating it religiously; Parmenides, his successor, developing the philosophical side of the doctrine; and Zeno, the pupil of Parmenides (not to be confounded with the great founder of the Stoics), defending it dialectically. Parmenides was born about 515-510 B.C., for we are told that he came to Athens with Zeno and saw Sokrates as a young man, the respective ages of the three philosophers being about sixty-five, forty, and twenty. Parmenides was of a wealthy family, and as a young man was addicted to pleasure, eventually forsaking worldly enjoyment voluntarily for the pursuit of philosophy. But he was no mere metaphysician. He drew up a code of laws for his native city of such excel-

lence that the citizens bound themselves yearly by oath to abide by it unalterably.

The main course of thought which Parmenides displayed in his great poem "Nature," written in flowing hexameters, of which fortunately several considerable fragments survive, was an attempt to clear up the conflict of reason and the senses, or in other words, of truth and opinion. He solved it by the first sketch of what afterwards became the celebrated doctrine of *Innate Ideas*. There is one true existence and only one, he asserts, and this cannot be apprehended by the senses, whose testimony is conflicting and confusing, but by thought and meditation alone. The ideas of the reason are the only true knowledge; the rest is opinion and uncertainty. As for this world of opinion and appearance, the realm of the senses, Parmenides considers its ceaseless variety to be due to the interchange of heat and cold, or of light and darkness, or of fire and earth, these couples being in his view different names for the same thing. Thus man originates from heat; when his heat dies out the body dies too. But in death he probably has still perception, only the perception of the corpse is not of heat in various degrees like that of the living body, but of cold. Nevertheless all this world of change Parmenides considered was appearance only. In reality there was only "being;" both "becoming" and "non-being" were in his view impossible. And as to the nature of this being, he taught that it was co-existent with the universe, and probably analogous to the sphere in shape or in constitution—that is, with neither beginning, middle, nor end, and yet at the same time self-limited. It is clear that the divine unity of Parmenides was held as finite, and not as infinite. Further, he sketched out the great doctrine of this one existence of the world considered as the "universal mind." "The one" and "thought" are identical, as appears by the fine passage so often quoted, beginning—

"Τούτων δίστοι νόον τε καὶ οὐρανὸν ἓστι νόημα," &c.,

which we may freely translate—

"Thought we perceive to be one and the same thing with what it is caused by;
If one would seek for the thought without that which the thought is expressing,
Truly it cannot be found. We perceive there is nothing, nor shall be,
Save only the being of beings, the one, the eternal existence."

Plato, and later on Aristotle, spoke of Parmenides with every possible respect; and the opinion held of him in antiquity cannot be better evidenced than by the large fragments preserved in quotation. These fragments have been often collected. The best edition is that of Karsten, in the "Philosophorum Gr. Veterum Op. rel." (Amsterdam, 1835.)

PARMENION was the most distinguished general of Alexander the Great, and had served his father Philip of Macedon before him. He was always chief in command, next under the king himself. It is most astonishing therefore that when, in B.C. 330, a dangerous plot was made against the king's life, and the son of Parmenion, who was arrested among the conspirators, groined out his father's name under torture, perhaps altogether in error, Alexander should at once have ordered Parmenion to be killed without the least investigation. His old servant was seventy, and had materially aided him to win those great battles which had set him at the head of the world, yet on a mere suspicion, perhaps from policy and without belief in his guilt, he ordered him to be sacrificed. There is not the slightest doubt but that Parmenion was innocent. The act is one of the puzzles of history; and as it rests, without explanatory evidence, it is the chief blot on the fame of Alexander.

PARMENTIERA is a genus of plants belonging to the order BIGNONIACEÆ. *Parmentiera cereifera* (the candle tree), found in Panama, is so called from the appearance of the fruits, which are fleshy, cylindrical, 3 or 4 feet long, and resemble yellow wax-candles. The fruit of another species, *Parmentiera edulis*, is eaten by the Mexicans. The flower of this species has a bell-shaped corolla and a deciduous calyx. The corolla is white or greenish in colour.

PARMIGIANO was the surname given to the favourite painter of Parma, the most distinguished pupil of Correggio. Like Parmigiano, Veronese, Perugino, &c., Correggio is better known by the name of his birthplace than by his own family name of Allegri. As for Parmigiano (or sometimes it is still further fondled into Parmigianino) his own name was Girolamo Francesco Maria Mazzuoli. He was born in 1504, and when but a lad was already famous for his clever imitation of the great painter who was his master. The five great names of Italian painting are undoubtedly Leonardo, Michelangelo, Raffaele, Titian, and Correggio; and had it not been for the overwhelming grandeur of this immortal group of artists, Parmigiano would have taken higher rank than he does. That is to say, he has much that is great besides the mannerism which he caught from Correggio, and at any other period of the art would undoubtedly have been a leader. As it is, he surpasses all the painters of North Italy of his time, except of course Correggio and Titian, and perhaps one or two more of the great Venetians, as Paolo, Tintoretto, Giorgione, and Bellini, who should rank, like himself, close beneath the greatest. Parmigiano excels in fine design, correct drawing, and felicity of invention, and in his later works shows a grandeur of conception in addition, which is precisely the quality occasionally deficient in the works of his master, and is therefore all the more remarkable. When just arriving at manhood he went to Rome to work at his art, and while there was employed by the second Medici pope, Clement VII. The great sack of Rome by the troops of the Constable de Bourbon took place in 1527, while Parmigiano was at work on the large canvas, "The Vision of St. Jerome," and a party of soldiers rushed into his studio in their work of plunder, to the equal surprise of the artist and of themselves, for they could scarcely credit the fact of his absorption in his work being such that he was unconscious of any of the fearful events proceeding around him, though the air was full of the deafening noise of artillery, and the houses rang with the shrieks of the dying. Their leader fortunately had enough sense of the beautiful to save the painter from more than a terrible fright. Certainly for a young man of twenty-three this is a very grand work, and it is readily visible, for we are fortunate enough to possess it in our National Gallery. But it must not be taken as showing the full force of the painter's genius, since the frescoes he executed in the Church of Sta. Maria della Steccata at Parma on his return thither in 1531 (after working at Bologna in the meantime) are far superior. Sir Joshua Reynolds, assuredly no mean judge, selected the magnificent figure in these frescoes, of "Moses breaking the Tables of the Law," as a typical specimen of correctness of drawing and grandeur of expression. The easel-picture "Cupid making his Bow," now at Vienna, is another splendid work, and the altar-piece "St. Margaret" at Bologna is scarcely inferior to it. Like most great artists (except those of the supreme order of genius), Parmigiano was somewhat capricious in work. His unpunctuality finally drove the authorities of Parma to put him in prison for breach of contract as a warning. He was soon released, but indignant at this treatment he fled into the territory of Cremona, and died there shortly afterwards at Casal Maggiore in 1540. Vasari says he poisoned himself with experiments in alchemy, but this has been lately shown to be a complete error.

PARNAHI'BA or **PARANAHYBA**, a river of Brazil, South America, which rises in the Sierra dos Coroados, about 11° S., flows N.E. and N., and enters the Atlantic by five mouths, inclosing a delta of 80 miles wide, in lon. 41° 40' W. Total length, 750 miles.

PARNAS'SUS (Gr. *Parnassos*), the name of a famous mountain in Greece, called at the present day Liakura. It is the highest in the kingdom, and the summit is covered with snow during a part of the year. Above Delphi, on its southern side, are two lofty rocks, whence the mountain is sometimes called "double-headed" by the poets. Between these two rocks is the renowned Castalian spring, a cool and limpid stream; and above the spring, and several miles from Delphi, is the Corycean cave, a stalactite grotto, 330 feet in length, by nearly 200 in width. The highest peak of Mount Parnassus is 8068 feet above the sea.

Parnassus figured in the Greek mythology as the favourite home of Apollo and the Muses, and in the Castalian spring the Pythia (priestess) used to bathe, deriving thence inspired strength of mind. Parts of the mountain were also sacred to the god of drama, Dionysos. At the foot of Parnassos, in one of the passes, was the narrow gorge where Æolipous slew his father Laïos, not knowing with whom he was disputing the path.

PARNAS'SUS, GRASS OF (*Parnassia palustris*), is a species of the genus Parnassia, belonging to the order SAXIFRAGACEÆ. It is found throughout Europe in marshy and damp places, and is common in the north of Britain in mountainous districts. At the base of the stem is a tuft of bright-green roundish leaves, and at the top a single white flower; between each stamen is a white fan-like nectary. Several species are known from North America.

PAR'NELL, THOMAS, the poet, was born in Dublin in 1679. He studied at Trinity College, Dublin, and became M.A. and took orders in 1700. In 1705 he received the archdeaconry of Clogher. On the ejection of the Whigs towards the close of Queen Anne's reign, he abandoned that party, and was cordially welcomed as an adherent by the Oxford administration, which, however, did not last after the queen's death. On the recommendation of Swift, however, he obtained a prebend from Archbishop King in 1713; and in May, 1716, was presented to the vicarage of Finglass. He died at Chester, on his way from London to Ireland, in July, 1717. A selected edition of his poems was published by Pope soon after his death, and dedicated to the Earl of Oxford. His best poem is the well-known "Hermion." Parnell was also the author of the "Life of Homer" prefixed to Pope's translation of the "Iliad," of certain papers in the *Spectator* and *Guardian*, and various unacknowledged performances.

PAR'ODY (Gr. *para*, beside, and *odê*, a song), a burlesque imitation of a grave or serious writing, differing from a burlesque in its closer following of the original. A travesty is also distinct in character from a parody, owing to its greater license and freedom of treatment. The invention of parodies is commonly attributed to the Greeks; and Aristotle records the first parodist to have been one Hegemon of Thasos, who flourished at the epoch of the Peloponnesian War. They were also cultivated by the Romans, and in modern literature have become a recognized institution. Probably the finest parodies in existence are in our own language, the humour of this form of composition being peculiarly adapted to the Teutonic genius, as any reader may convince himself by turning over the pages of the "Rejected Addresses," or the "Ingoldsby Legends" of our own day, or Beaumont and Fletcher's "Knight of the Burning Pestle," the Duke of Buckingham's "Rehearsal," Sheridan's "Critic," and Fielding's "Tom Thumb" of our forefathers. Thackeray parodied several popular novelists with excellent truth and force, and admirable parodies on well-known songs and poems constantly appear in the

hebdomadal pages of *Punch*. Parody, however, sooner palls upon the reader than most kinds of wit. Except in its finer forms it is very easy; and, in long instances, tiresome from its casiness, sometimes from its vulgarity. It is essential to the success of a parody that it should be upon some familiar subject or in some well-known style, or it would not be easily understood by the general public.

PAROLE. This term, which signifies "a word," has been adopted from the Norman-French as a term in English law, to denote verbal or oral proceedings, as distinguished from matters which have been recorded in public tribunals or otherwise reduced to writing. A parole contract is an agreement by word of mouth or simple writing, as opposed to a contract by deed. Parole evidence is the testimony of witnesses given orally, as opposed to records or written instruments. This is the popular acceptance of parole; but, strictly speaking, everything, even in writing, is parole which is not under seal.

PAROLE, the countersign, password, or watchword given to guards and sentries in camp and garrison, and demanded by them of all who approach their posts, and on giving which alone they permit them to pass. *Parole* is also the promise made on honour by an officer or prisoner of war, in which case there is no more than his sense of honour to restrain him from breaking his word. Prisoners of war are often released on parole that they will not take up arms against their captors again, or that they will give themselves up when desired.

PAROPAMISOS is an ancient Greek name for the great range of mountains called the Hindu Kush, running from west to east through Central Asia, and dividing the watershed of the Indian Ocean from the great central table-land of Tartary and Tibet. The especial part of the chain bearing this name, which is still frequently used, is that between Kohistan and the Himalayas. The first part of the name *Paropamisos* is the Persian *paru* (mountain); the second part is much contested, and is still obscure. The name *Kush* is a corruption of *Caucasus*, as the Greeks often called this chain the "Indikos Kaukâsos," after Alexander had crossed it; and thence "Hindu Kush" has followed by an easy transition. The most ancient poets had described Caucasus as the end of the world, and as the Euro Asiatic Caucasus had been proved not to be so, the soldiers of Alexander jumped to the conclusion that these great central mountains of Asia must be those spoken of. The fact was of course that the poets only wrote of what they knew in their own early times, when the world did not extend beyond the shores of the Mediterranean and the Black Sea.

PAROS, one of the larger Cyclades, is situated west of Naxos, from which it is separated by a channel 5 or 6 miles wide. It is about 36 miles in circumference. The surface is hilly but fertile, producing corn, wine, oil, cotton, and Parian marble the last of the finest quality, of which the best ancient statues were made. There is abundance of fruit, flocks of sheep and herds of swine, and plenty of partridges and other game. The marble quarries are about 4 miles east of the principal town, Parehia or Paros, on the west side of the island, which contains numerous remains of the ancient city. The marble was obtained chiefly from tunnels driven into the rock, and from the circumstance that the work had to be carried on by lamp-light the marble was known as *Lychnites* or *Lygdos*, from Gr. *lychnos*, a lamp. The harbour, on the north-east coast, Port Nassau, is the best in the Archipelago. The mountain Marpesus, now Capresso, near the centre of the island, also contains abundant white marble, which was used by the ancient sculptors. The Greek inscription called the *PARIAN CYCLOPICTE* was found on this island, which belongs to the modern kingdom of Greece. West of Paros, and separated from it by a narrow channel, is Antiparos.

PAROTID GLAND (from Gr. *para*, beside, and *ous*, *otos*, the ear) is the largest of the three principal glands by which the saliva is secreted and poured into the mouth. The parotid glands are situated, one on each side of the face, behind the ascending part of the lower jaw, and below and in front of the ear. The structure of the parotid is lobulated, being made up of a number of minute cells, the termination of the branches of the main duct, upon whose walls a network of capillary bloodvessels is arranged, and which are collected together in uncertain numbers to form the several lobules of which the whole gland is made up. The principal disease to which the parotid gland is subject is the mumps. See MUMPS.

PARQUETRY. See MARQUETRY.

PARR is the name given to the young of several species of the salmon tribe. Parr were at one time considered to constitute a distinct species, *Salmo salinus*. They are characterized by having the sides adorned with a number of broad dark bars, called parr-marks. The common salmon has eleven or more of these lateral bars till its first migration, at the age of two years, to the sea, on its return from which they have disappeared. The river-trout has seven parr-marks, and in some waters retains them throughout life. The grayling has also a parr stage.

PARR, SAMUEL, LL.D., an eminent scholar and divine, was born at Harrow-on-the-Hill, 15th January, 1747, where his father was a surgeon and apothecary. He received his education at the Harrow grammar-school. In his nineteenth year he was sent to Emanuel College, Cambridge, where he applied himself diligently to classical studies. His father dying before his academic course was completed, he was obliged to leave college, and became, in 1767, one of the masters of Harrow School, where he remained five years. He successively kept a school at Stanmore, Colchester, and Norwich. In 1786, having some time before taken orders, he obtained the small living of Hatton in Warwickshire, where he spent the rest of his life in his parochial duties and in the instruction of youth. He never had any other preferment, except a stall in St. Paul's.

Parr had considerable talents, and a great deal of learning. He was kind and benevolent, but arrogant and domineering. He died in 1825, leaving behind him a great mass of papers, consisting of his correspondence and other things, which fill eight thick 8vo volumes, as published by Dr. J. Johnstone. He left no great work behind him, and his reputation mainly rests on the tradition of his colloquial powers, a reputation, however, purchased, as such reputations generally are, by disregard of the courtesies of society and a self-sufficient and overbearing manner.

PAR'RA. See JACANA.

PARRAKEET or **PARROQUET** is the name given to many of the smaller species of parrots belonging to the family Psittacidae, and especially to those of the subfamilies Palaeornithinae and Platycerinae.

The Alexandrine or Ring Parrakeet (*Palaeornis Alexandri*) is so named from the supposition that it was the species brought from India by Alexander the Great; but the honour of being the first parrot to enter Europe must probably be rather given to the nearly allied species, *Palaeornis torquatus*. It is 15 inches in length, including its long, graduated tail; its body is about the size of that of a pigeon. Its general colour is a beautiful bright green, paler beneath; the lesser wing-coverts are purplish red, and across the back of the neck is a beautiful collar of the same colour, bounded above by a black line, which is continued up on each side to the base of the lower mandible. The bill is bright orange-red. This beautiful bird is a native of Java. The young are easily tamed, when they become very docile, and may be taught to speak a few words.

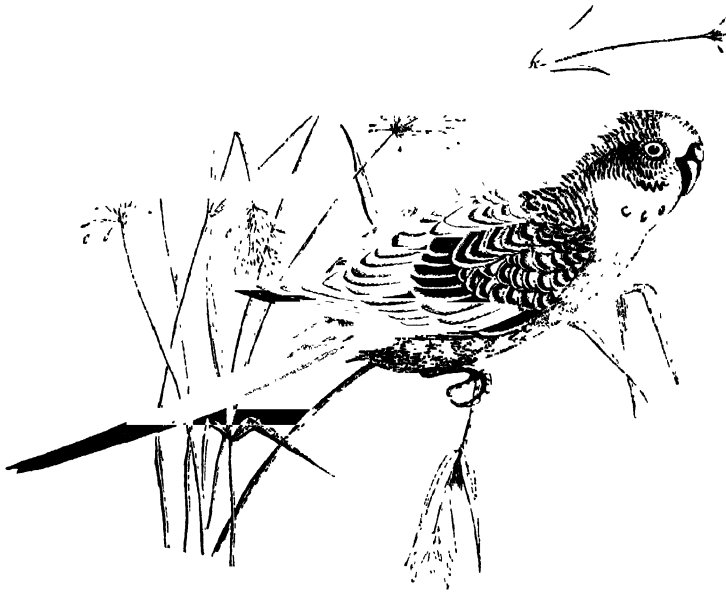
The Rose-ringed Parrakeet (*Palaeornis torquatus*) is

abundant in India, and is fond of dwelling in the vicinity of human habitations, frequently even breeding in the cavities of buildings. It is about the same size as the Alexandrine parakeet, and like it of a fine green colour; it has the throat and collar black, and the band on the back of the neck is rose colour. It is said to be very destructive to the grain crops in India.

The subfamily *Platycecinæ* is confined to the Australian region. It includes parrots with long tails and gorgeous coloration; some, however, are ground-feeders and have less brilliant plumage. The Warbling Grass Parakeet (*Melopsittacus undulatus*) is found exclusively in the vast plains of central Australia, where it occurs in great abundance, flying in flocks of many hundreds, and feeding on the seeds of the

grasses with which those deserts are clothed. The length of this species is about 7 inches; the colour of its plumage above is olive-green, delicately marked with undulated black or dusky lines; the head and back of the neck are yellowish-green, with a small azure patch upon each cheek; the lower surface is a delicate yellowish-green; the two middle tail-feathers are green at the base and blue at the tips, and the remainder are green, tinged with yellow in the middle. It is a favourite cage-bird.

The Ground Parakeet (*Pezoporus formosus*) is common in Southern Australia and Tasmania. The genera *Pezoporus*, *Melopsittacus*, *Euphema*, and *Geopsittacus* are also ground-feeders, and are placed by Garrod in the family *Strigopidae*. The present species measures rather more



The Warbling Grass Parakeet.

than 12 inches in length, including its long-pointed tail; its plumage is of a lively green colour above, elegantly spotted with black, while the lower surface is variegated with delicate, undulated, transverse bars of green, black, and yellow. At the base of the upper mandible there is an orange-red band. This charming little bird is met with sometimes in sandy barren districts covered with tufts of grass and herbage, sometimes about swampy flats; it passes nearly the whole of its time upon the ground, is never seen to perch, and when flushed takes a short flight, and then alighting again runs on until it finds a place of safety. It even deposits its eggs on the ground. Mr. Gould says that its flesh is excellent and much more delicate than that of the snipe.

The Crested Parakeet (*Nymphicus noræ-hollandiæ*) is a small species, pale olive-brown in colour, with its head bright yellow and adorned with a crest of long yellow feathers. It is abundant in some parts of New South Wales.

PARRHASIOS, one of the great painters of the ancient Greeks, son and pupil of Euvéor, was a native of Ephesus, but became a citizen of Athens. He raised the art of painting to great perfection. He declared himself to be descended from Apollo, and carried his arrogance so

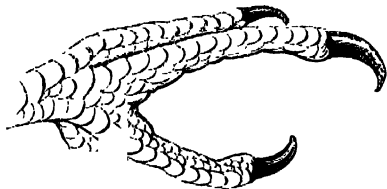
far as to dedicate his own portrait in a temple as Hermès, and thus to receive the adoration of the multitude. He wore a purple robe and a golden garland; he carried a staff wound round with tendrils of gold, and his sandals were bound with golden straps. Pliny terms him the most insolent and the most arrogant of artists. The branch of art in which he eminently excelled was a beautiful outline. One of his most celebrated works was his allegorical figure of the Athenian people, or Demos. He painted a Thésus, which after the general spoliation of Greece, was placed in the Capitol at Rome; and a Héraklès, famous in antiquity, which he maintained was a fac-simile of the god as he had appeared to him in dreams. Parrhasios flourished about 400 B.C.

PAR'RICIDE. In the Roman law a parricide was one who murdered a near relative, and the punishment was more severe than for any other murder, viz. being sewed up in a leather sack along with a live ape, viper, cock, and dog, and thrown into the sea to take his fate with these companions. In England the term is popularly confined to a person who murders his or her own father. The punishment is the same as for the murder of a stranger.

PAR'ROT is the general name given to a large group of birds, now usually held to constitute a distinct order,

Psittaci. The parrots are remarkable for the splendour of their plumage, and the readiness with which they may be taught to imitate the human voice. They are pre-eminently a tropical group of birds, but a few species are found beyond the limits of the tropical and subtropical regions. Thus the Caroline Parrot (*Conurus carolinensis*) at one time ranged as far north as Lake Ontario, and is now found in the southern and south-western states of the Union; and another species of *Conurus* reaches the Straits of Magellan in the South. Parrots inhabit South America, Africa, India, Malaya, and the Australian region—the last, though the smallest in area and the least tropical in climate, being the richest in genera and species. South America possesses a great number of parrots, among which are many of the largest and most beautiful forms.

The parrots have short, robust, reticulated tarsi, and prehensile feet adapted both for climbing and for carrying the food to the mouth; the toes are directed two forwards and two backwards. The bill is large and strong, with the



Foot of Common Parrot.

upper mandible much longer than the lower, strongly hooked, sharp pointed, and articulated with the frontal bones by a complete hinge-joint. The base of the upper mandible is enveloped in a naked membrane in which the nostrils are pierced. The tongue is soft, thick, and fleshy, and its whole structure indicates a greater acuteness of the sense of taste than is usual among birds. The wings are generally short and weak. Both gall-bladder and intestinal caeca are absent, which is also frequently the case with the furcula.

Parrots are for the most part gregarious, generally inhabiting forests in large flocks, and feeding on fruits, seeds, and nuts; they are monogamous and build their nests in hollow trees. A few species, however, live mostly on the ground. The natural cry of most parrots is harsh and discordant. Parrots were known, at least by name, at an early period to the Greeks, and the conquests of Alexander of Macedon seem to have made them familiar with several Indian species. It was not until the time of Nero that the Romans became acquainted with the species indigenous in Africa. In the degenerate days of the empire parrots were esteemed not only for their appearance and intelligence, but also as delicacies for the table.

The order Psittaci may be divided into the following families:—Strigopidae, containing the KAKAPO or Owl Parrot only; Nestoridae, containing the genus NESTOR; and Psittacidae, containing the rest of the group. The family Psittacidae may be broken up into minor groups (to which some give the rank of families):—Cacatuidae, containing the COCKATOOS; Arinae, containing the MACAWS and the genus CONURUS; Palaeornithina and Platycercina, containing many of the forms known as PARIAKEETS; Loriinae, containing the LORIES (see LORY); and Psittacinae, containing the genera Psittacus, Chrysotis, &c.

The number of birds to which the name parrot is popularly applied is very great, and it will only be possible to mention a few of the best known species. The Gray Parrot (*Psittacus erythacus*) is a bird frequently kept in confinement, in which it displays the greatest docility and intelligence, surpassing in powers of speech any other

parrot. It is an inhabitant of tropical Africa, where it dwells in the woods, feeds upon seeds and the kernels of fruits, and breeds in the holes of decayed trees, laying about four white eggs. In confinement, and probably also in a state of nature, it generally holds its food in one of its feet, and then bites pieces from it. The strength of its bill enables it readily to break the shells of nuts and almonds, so as to get at their sweet kernels. This parrot is about 12 inches long, of an ashy-gray colour, with a short crimson tail.

The Green Parrot or Amazon (*Chrysotis amazonicus*), which is even a more common bird in this country than the gray parrot, is an inhabitant of the rich forests of South America watered by the river Amazons, where it occurs, with other allied species, in immense numbers. It is a little larger than the gray parrot, and its plumage is of a fine grass-green colour, with the edges of each feather dusky; the forehead is bluish, and the head and throat yellowish; the spurious wing is red, and the wings and tail more or less variegated with green, black, red, and yellow. This species appears to be liable to considerable variation. It is tolerably docile, and learns to speak pretty readily, but is generally inferior in both these respects to the African gray parrot. These birds not unfrequently descend upon plantations situated in the vicinity of their haunts, and do great mischief. An allied species, native of the same forests, and also a favourite in confinement, is the Festive Parrot (*Chrysotis festinus*). In our Plate are given figures of the Scarlet Macaw, Gray Parrot, Smouldering Gray Parrot, and the Bonneted Psittacule.

PARROT-FISH and PARROT-WRASSE are names given to fishes of the Wrasse family (Labridae), belonging to the genus *Scarus* and other closely allied genera. The parrot-fish are remarkable for the structure of their jaws and teeth, the jaws being divided by a median suture, and the teeth incorporated with the jaws in crowded quincunxial rows. The body is oblong and stout, covered with large scales. The name parrot-fish is derived from the resemblance of the jaws to a parrot's beak, and from the brilliant colours with which the tropical species are adorned. The genus *Scarus*, as restricted by Dr Gunther, contains one species found in the Mediterranean and nine from the tropical Atlantic. The Mediterranean species (*Scarus cretensis*) was considered a great delicacy by the ancient Greek and Roman epicures. The modern Greeks call it *scuro*, and eat it with a sauce made of its own liver and intestines. It feeds on seaweeds. The majority of the parrot-wrasses belong to the genus *Pseudoscarus*, which is chiefly distinguished from *Scarus* by having the upper jaw projecting beyond the lower, and two or more series of scales on the cheek. There are about seventy species of the genus *Pseudoscarus*, all tropical, and glowing with the most brilliant and varying colours. They feed on seaweeds and coral, and some are poisonous when eaten.

PARRY, ADMIRAL SIR WILLIAM EDWARD, a celebrated Arctic navigator, was the fourth son of Dr. C. H. Parry, of Bath, and was born in 1790. He entered the navy in 1803 on board the *Ville de Paris*, and received his commission as lieutenant in 1810. After being engaged in active service, especially against the Americans, he received a commission, in 1818, to join Sir John Ross's expedition to discover the probabilities of a north-west passage to the Pacific, as lieutenant in command of the *Alexander* brig. On the failure of that undertaking the admiralty ordered a second expedition to be equipped, which was intrusted to Parry; and to the success attending this voyage his early fame may be attributed. The two ships were the *Hecla* and the *Griper*, which left the Thames on the 11th of May, 1819, and reached Melville Island at the beginning of September. Having thus crossed the meridian of 110° W., in lat. 74° 44', he became entitled to the reward of £5000 which had been offered by Parliament to those who

should succeed in penetrating so far westward within the Arctic circle. The expedition wintered at Melville Island, and re-entered the Thames in November, 1820. The gallant commander was received with every public demonstration of honour, and promoted to the rank of commander. In 1820 he was commissioned to take charge of the *Fury*, and to make another Arctic voyage, in company with the *Hecla*, commanded by Captain Lyon. This expedition extended over the years 1821-23, and underwent great hardships; but the vessels eventually returned in safety. The same ships were afterwards refitted for another Arctic voyage, upon which they sailed from the Thames on 8th May, 1824; the *Hecla* commanded by Captain Parry, and the *Fury* by Captain H. P. Hoppner. The following winter was passed at Port Bowen, in Prince Regent's inlet, where the two vessels remained from 28th September, 1824, until 20th July, 1825. The *Fury* was shortly afterwards wrecked, and the *Hecla* reached England in the following October with a double ship's company. Shortly afterwards Captain Parry was appointed hydrographer to the admiralty. Having proposed and obtained sanction to a plan for reaching the North Pole by means of sledges from the northern shores of Spitzbergen, he was again appointed to the *Hecla*. After great labour and danger this expedition attained the latitude of $82^{\circ} 45'$, which was the nearest point to the North Pole that had hitherto been reached. He retraced his steps to the *Hecla*, which he brought home, 1st November, 1827. This ended Parry's long and arduous services in the Arctic regions.

In 1837 Captain Parry was appointed to organize the Packet Service, then transferred to the admiralty; and from 19th April, 1837, to December, 1846, he was comptroller of the steam department of the navy. He afterwards held the office of captain superintendent of Haslar Hospital, and more recently that of governor of Greenwich Hospital, which he held at the time of his decease. In 1852 he attained the rank of rear-admiral. He died at Ems, in Germany, on the 8th of July, 1855. A complete edition of his voyages was published in 1833. His life has been written by his son, the Rev. Edward Parry, M.A., of Balliol College (third edition, Oxford, 1857).

PARSIS or **PARSEES** (that is, the people of Pars or Vars, the name of ancient Persia) are the remnant of the followers of the old Persian creed, as reformed by Zoroaster or Zoroaster, and having been driven from Persia by the persecutions of the Mohammedans, are thus distinguished by English writers. It is now fully established that the ancient Persians entered the Punjab with the ancestors of the Hindus, whence after a time they moved away westward to Bactria, Media, and Persia. This is proved by the affinity between Zend, formerly the spoken and still the sacred language of the Zoroastrians, and Sanskrit, the ancient language of India; from the fact that in primitive times both peoples were known as Aryans; and from the many points in connection with mythology and religious ceremonial common to both the systems of Zoroastrianism and Brahmanism. It appears also that at some remote period the separation of the two peoples extended to their religion, and either as a consequence of social and political conflicts, or as a result of a religious reformation in Persia, the deities of the Hindus became the demons of the Zoroastrians. Much obscurity rests over the reformation effected by Zoroaster, and scholars differ widely in their estimates as to the date when it took place, Bunsen fixing it as early as 8000 B.C., while others place it as late as 1500 B.C. It must have taken place earlier than 1200 B.C., as Zoroastrianism was established in Bactria when that country was conquered by the Assyrians about that period. Of its subsequent history very little has been ascertained up to the present; but at the time of the conquest of Alexander the Great, 331 B.C., it flourished throughout the greater part of ancient Irania,

including Upper Tibet, Cabulistan, Logdiana, Bactriana, Media, and Persia, and as Max Müller observes: "There were periods in the history of the world when the worship of Ormuzd threatened to rise triumphant on the ruins of the temples of all other gods. If the battles of Marathon and Salamis had been lost and Greece had succumbed to Persia, the state religion of the empire of Cyrus, which was the worship of Ormuzd, might have become the religion of the whole civilized world."

From the death of Alexander, however, it rapidly declined in power and influence, and it was not until the reign of Artashir Babegan, the founder of the Sassanian dynasty of Persia, which commenced in 226 A.D., that Zoroastrianism regained anything of its former splendour. Under the rule of this monarch the magi or priests were invested with much power and authority, the sacred books were reduced to writing, and translated from Zend into the vernacular Pehlvi, and temples for the adoration of the sacred fire were erected throughout the empire. Under the later Sassanians the sacred books were translated into Parsi, an older form of the modern Persian, and the Zoroastrian religion flourished for the next four centuries, all other forms, including Judaism and Christianity, being proscribed and persecuted. But the rise of Mohammedanism was fatal to Zoroastrianism, and it was all but destroyed by the invasion of the Arabs, under the generals of the Caliph Omar (634-644 A.D.). Some of its adherents who remained faithful withdrew to the mountainous region of Khorassan, where a few of their descendants are found to day [see GREENES], while others moved eastward, until they found a resting-place on the western shores of India, their descendants being the modern Parsis. They appear to have settled first at Guzerat, from whence they passed on to Surat and Bombay. Under British rule they have flourished exceedingly, and they now form one of the most respectable and thriving of the communities of the Indian Empire. According to the census of 1881-82 there are, in the Presidency of Bombay, 72,065 Parsis, of whom more than one-half dwell on the island of Bombay itself. Parsis have also settled for commercial purposes in many of the large cities of British India, and they are also represented in Burma, China, and other parts of Asia, in Persia, Egypt, and London. The number of Parsis in all India in 1881 was 85,397 and it is estimated that there are about 10,000 in Persia and elsewhere. The total number does not certainly exceed 100,000.

Like the Jews, whom in many respects they resemble, they have maintained their purity of race through all their migrations, and until they came into contact with Western thought they ever firmly adhered to their original religious ceremonial. In appearance they are a handsome, well-formed race, light olive in complexion; the males dignified and intelligent, and the women remarkable for their beauty. By dint of great commercial enterprise, sagacity, and a high standard of probity in business transactions, they have acquired much wealth, and their credit as merchants is almost unlimited. They have some fifty large commercial houses in Bombay alone, and they have numerous houses also in Calcutta, Hong Kong, Shanghai, Yokohama, and London.

In religion they accept the dualism taught by Zoroaster, and worship the good spirit Ahurā Mazdā or Ormuzd, and certain subordinate deities, with much ceremonial. They believe in moral responsibility, in a resurrection, and a future life, and their ethical creed certainly embodies the fundamental principles of all religion in its three words—"purity of thought, purity of word, and purity of action." They compute their time from the fall of Yazdagird, the last king of the Sassanian dynasty, dividing their time into twelve months of thirty days each, five holy days of the year being kept separate from this reckoning. Each period of the year has its peculiar feasts and observances, in some

of which an elaborate ritual is observed. There are only two castes recognized among them—the priests and the laymen; but the priests have three divisions among themselves—*dastürs*, or high-priests; *mobeds*, or the middle order of priests; and *herbads*, or priests of the lowest rank. The priests preside over public worship, attend to the sacred fire, receive the young Parsis, at the age of seven or thereabouts, formally into the religion of their fathers, celebrate all marriages, attend the dying, and conduct the funerals of the dead. The high-priests are usually intelligent, well-informed men, but the priests of the middle and lowest class are very ignorant, and seldom understand the liturgical portions of the sacred books which they mechanically repeat in their various services. In addition to the public services all devout Parsis begin the day with prayers, after which they touch their faces, hands, and feet with *uirang* (cow urine), reciting at the same time an incantation to ward off the influence of evil spirits. At least sixteen prayers should be recited every day, and while praying the worshipper should face the sun, a light, or fire—a holy fire being constantly maintained in the Parsi temples. At the same time they repudiate the name of fire-worshippers, which is frequently applied to them by Mohammedans and others, inasmuch as they regard the sun, the moon, the planets, and fire merely as symbols of the invisible Ahurā Mazda. They will not play with fire, or extinguish it unnecessarily, and on this account they stand alone among Orientals as a race of non smokers, but they do not carry their reluctance to extinguish fire to the extreme commonly supposed. The more liberally-minded among them speak of their reverence for fire as being merely the respect due to a sacred symbol, and compare it to the sentiment of veneration which many Christians feel for the cross, the Bible, &c., but all are not so intelligent. The duties of hospitality and charity form an essential feature in their religion; and while they are eager in acquiring wealth, they dispense it liberally in works of benevolence. In the treatment of their women they are far above the majority of Orientals, allowing them to appear freely in public, and committing to them the entire management of household duties. Fornication and adultery are crimes sternly forbidden by their religious tenets, and polygamy, except after nine years of sterility on the part of the wife, or her unfaithfulness, is not permitted. Under English influence the Parsis have made much progress in education, and they have allowed their women to participate in its benefits, and as a natural result, many of them now hold but lightly to the mythology of their fathers, though they still maintain the ancient observances. One custom which deserves special notice from its singularity, is in reference to their disposal of the dead. After death the body is washed, anointed, and wrapped in clean white clothes, is carried to a lonely tower, called the “tower of silence,” where it is laid upon an iron grating a few feet above the ground, where the flesh and leave the bones to fall through the grating into a receptacle beneath, from which they are removed and buried. The funeral, which is attended by the priests and the male friends of the deceased, is rather a joyous than a mournful ceremony, and the event is made the occasion of charitable gifts and donations. Special religious ceremonies are annually performed at home in memory and on behalf of the dead, and one day in the year is also specially set apart for public services of a similar kind. (See Max Müller’s “Chips,” &c., vol. i., second edition, London, 1868; and “Lectures on the Science of Language,” also Dadabhai Naoroji’s “Manners and Customs of the Parsees and the Parsee Religion,” Liverpool, 1861.)

There are two reasons why the Parsis attract an attention quite out of proportion to their actual numbers, the whole community only counting some 85,000 among 250,000,000 who inhabit the Indian Peninsula. The first

is the romantic interest attaching to the vicissitudes of a sect which has preserved the religion and traditions of perhaps the most splendid empire the world ever knew; the second is to be found in their own energy, ability, commercial and official success. Of the manners and aspirations of the Parsees of the present day, Mr. Dosabhai Framji Karaka gives an exhaustive account in his handsome, well-illustrated volumes, on the “History of the Parsis” (London, 1885). This account may be taken as the most authoritative one of this curious people, as its author was a presidency magistrate and chairman of justices in Bombay, and a C.S.I. to boot. It is evident from Mr. Framji that young Parsism is inclined to put a liberal interpretation on the customs of its forefathers, and that the community has taken important steps in the advancement of education, especially in the direction of female enlightenment. Its eclecticism is not confined to civil and domestic life alone. Efforts are being made to reconcile its religious philosophy with the spiritual ideas of the West.

PARSIFAL. See PIERCEVALE.

PARSLEY (*Petroselinum*) is a genus of plants belonging to the order *UMBELLIFERÆ*. The Common Parsley (*Petroselinum sativum*) occurs wild in the south of Europe, and is cultivated largely for culinary purposes. Parsley is spoken of by Pliny but only as a wild medicinal plant. The first trace of its cultivation is in the time of Charlemagne, and it seems to have reached England about 1518. The parsley is a biennial branching herbaceous plant with small yellowish or greenish flowers in compound umbels and bipinnate triangular leaves. Under cultivation two varieties have been established, that with curled and much divided leaves being preferred. The leaves, root, and other parts have a peculiar aromatic odour and taste. The leaves of the curled or garden parsley are used for garnishing and for seasoning soups, &c.

Hamburg Parsley is a variety with large roots which are edible and used like carrots. The seeds of the parsley are slow in germinating, and are usually sown every year; but if the plants be prevented from flowering they last several years. Frequent transplanting is said to make the leaves of the garden parsley more divided, but there is a superstition in England, especially in the midland counties, that to transplant it brings bad luck. Parsley was at one time valued as a medicinal plant, and the root is now occasionally used as a diuretic. It is useful as neutralizing other strong odours, such as that of onions or of garlic. The Fool’s Parsley (*Aethusa cynapium*) is a highly poisonous plant, closely resembling the plain-leaved parsley, for which it has been sometimes mistaken with fatal results; in flower the two may be easily distinguished, for each partial umbel of the poisonous plant has an involucre of three long narrow leaves, while the true parsley has none. *Petroselinum* is placed by Bentham and Hooker in the genus *Carum* under the name *Carum Petroselinum*. The Corn Parsley (*Carum segetum* or *Petroselinum segetum*) is a small white-flowered annual occurring in hedgebanks and cornfields in Southern and Central England; it is also found in parts of Central Europe and Western Asia.

PARSNIP (*Pastinaca*) is a genus of plants belonging to the order *UMBELLIFERÆ*. The Common Parsnip (*Pastinaca sativa*) is found wild in Central and Southern Europe and West Central Asia; it is indigenous to England, particularly in chalky or gravelly soil, but does not occur in Scotland in the wild state. It is a biennial with a branching stem about 2 feet high, with pinnate leaves bearing ovate serrated leaflets, and the flowers arranged in compound umbels with involucre. The parsnip has a hard tap root with strong branches; under cultivation the branches become insignificant, and the root becomes thick, soft, and fleshy; the stem is also taller, and the leaves longer and smoother than in the wild state. As an

instance of the efficacy of careful selection Darwin quotes the instance of Professor Buckman of the Royal Agricultural College, having in four years converted parsnips raised from wild seeds into a new and good variety.

The root of the parsnip has been valued from an early period, having been eaten by the Romans, who also ate the leaves to promote digestion. The root is highly nutritious, sweet, and aromatic. It is very hardy and is improved by frost. In addition to being a table vegetable it is employed as food for cattle, improving the quality both of the butter and the meat. There are only a few varieties. The common or Dutch parsnip has a root 20 to 30 inches long, and 3 or 4 inches in diameter at the thickest part. The Guernsey, peculiar to the Channel Isles, has long tapering roots, sometimes as much as 4 feet in length. The hollow crowned, considered the best variety, has a depressed ring around the insertion of the leaf-stalks; it is about 18 inches long and 4 in diameter. The turnip-rooted is longer than broad. In Ireland a sort of beer is made by washing the roots, boiling them with hops, and allowing the infusion to ferment. A wine is also made in England and Ireland, and is considered to approach Malmsbury wine.

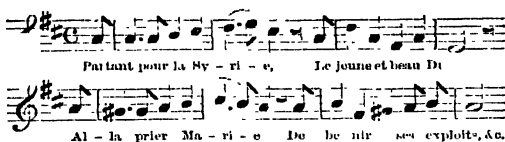
PARSON-BIRD (*Prothemodera novæ-zelandiæ*), a bird belonging to the family of HONEY-EATERS (Meliphagidae), and one of the most abundant birds of New Zealand. It is about the size of a thrush, and of a black colour, with a curious tuft of white feathers on each side of the neck, whence the name of the "parson-bird" has been given to it by the European settlers. Its native name is Tui. It possesses a wonderful talent for imitation, exactly mimicking the notes of all the other feathered inhabitants of the woods; hence it is sometimes called the mocking-bird. In confinement it learns to imitate other sounds, such as the noises of dogs, cats, poultry, and even to speak long sentences with great correctness. The food of this bird consists principally of insects, in search of which it exhibits an incessant restless activity; it also feeds on berries and earthworms.

PARSONSTOWN or **BIRR**, a town of Ireland, in King's County, situated on the Great Southern and Western Railway, 89 miles south-west of Dublin, on gently rising ground. In the square near the centre of the town is a low Doric pillar, in memory of the Duke of Cumberland and his victory at Culloden, erected in 1747. The Protestant church and the Roman Catholic cathedral are fine buildings. There are also Presbyterian, Methodist, and Quaker meeting-houses, a fever hospital, dispensary, schools, union workhouse, and good hotels. A mile from the town are the barracks, capable of containing three regiments of infantry. A considerable corn trade is carried on, and there is a distillery and a brewery. **Birr Castle** is chiefly interesting for the great telescope built by the Earl of Rosse, the speculum of which weighs 3 tons. **Parsonstown** is derived from the Rosse family name, and **Birr** from the ancient abbey of Biorra founded by St. Brendan. The population in 1881 was 4955.

PARTANT POUR LA SYRIE, a French air most admirably adapted for the purpose it was made to serve as the national anthem of the Second French Empire. It was tawdry, commonplace to vulgarity, weakly sentimental, and in fact musically worthless. There was nothing heroic, nothing even military about it. It was the paltriest tune ever played on dignified occasions, and fitly imaged forth the reign of Napoleon III.

The tune was claimed by Queen Hortense, the mother of Napoleon III., and was written in 1809 by her or for her (as her music master also claimed it after her death) to a little sentimental poem of Count Laborde, about Dunois the young and handsome departing for Syria, and praying the Virgin that he might love the fairest lady and be the bravest knight. It will certainly be one of the curiosities

of the future how a great nation could bear with so poor a piece for years as its national anthem.



PAR'THENOGENESIS (Gr. *parthenos*, virgin, and *genesis*, birth). In all animals above the Protozoa reproduction is usually sexual; that is to say, the fertilized egg from which each individual springs is the result of the union of male and female elements. Asexual reproduction, by fission and gemmation, does occur among the Metazoa, but rarely and as an alternation with sexual. Between the two is parthenogenesis, virgin or agamic reproduction, which is the development from an unfertilized egg of a female which has either the ordinary structure or is more or less modified. This form of reproduction must not be considered asexual, for even in extreme cases the organs from which the unfertilized eggs proceed may be regarded as rudimentary ovaries.

Parthenogenesis is tolerably frequent among the Arthropoda, and especially among insects.

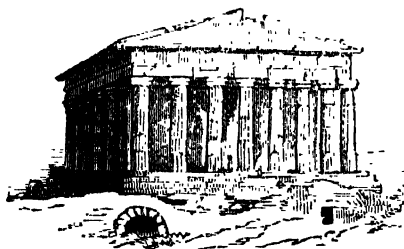
In the case of the plant-lice or Aphidae, the fertilized eggs laid towards the end of autumn hatch out in the spring only female forms, which are somewhat differently constructed and produce viviparously without fertilization a brood of similar forms. The second brood can reproduce themselves parthenogenetically in about two weeks, about eighty young being produced at a birth. Successions of these agamic broods continue throughout the summer, till as the cold weather draws on, or food becomes scarce, male and female forms are suddenly produced, the latter being always wingless, though among the modified females both winged and wingless forms occur. The true female forms are fertilized by the males, and lay eggs which develop in the following spring.

Another interesting form of parthenogenesis occurs in the case of the honey-bee. The queen bee is fertilized in her marriage flight once for all, and the spermatozoa are squeezed out from a receptacle on the eggs as they are laid. The eggs, however, which produce drones or males are unfertilized, and similarly it happens that if the queen's body be injured or in old age, only unfertilized eggs are laid, and only drones developed. The so-called "neuters," which are really imperfect females, may also rarely produce eggs without fertilization, but these give rise to males only. This production of males from unfertilized eggs has been shown to obtain in the case of some species of wasps.

Parthenogenetic reproduction may even be thrown back into larval life. This is the case in two genera of flies (Diptera). In the genus *Miasia*, belonging to the Cecidomyiidae, the larva produces from a rudimentary ovary a number of eggs which develop into larva within the body of the parent. To this phenomenon, which also occurs in the genus *Chironomus*, the name *parthenogenesis* has been given. Even the complicated development of the liver-fluke and some other Trematodes may be regarded as cases of alternations of a sexual with several parthenogenetic generations. Parthenogenesis also occurs in Phylloxera and Psychidae among insects, among the lower crustaceans, as *Apus* and *Daphnia*, and in the rotifers.

PAR'THENON, the temple of the virgin goddess *Athéna* (Lat. *Minerva*), the protectress of Athens, is situated on the Acropolis of that city. Loeschke in 1882 proved that it was begun in 447 and finished in 433 B.C. The architects were Kallikrates and Iktinos, working under the instructions of Pheidias, and the sculptures were executed by Pheidias and his assistants. It has always been con-

sidered the most splendid example of the Grecian Doric style, and the noblest monument of antiquity. Yet its grandeur was by no means owing to its extraordinary dimensions, since in point of size it falls far short of many other structures, modern as well as ancient; its extreme length being only 227 feet, its breadth 101, and its height 65; and the interior of the cella only 145 feet 6 inches by 63 feet 6 inches. It was shattered by an explosion in 1687, when it was used as a powder magazine by the Turks, at the time of the city being besieged by the Venetians, and the interior of the temple had been more or less injured by having been converted first into a Christian church, and afterwards into a Turkish mosque. Still, even in its present ruined and mangled state, it is the admiration of all travellers and artists who have beheld it.



The Parthenon.

The chief portion of the sculptures of the edifice were removed by Lord Elgin, and are now in the British Museum. [See ELGIN MARBLES.] One object of art that originally decorated the interior or shrine was the chryselephantine statue of Athena, 39 feet high, which was the work of Pheidias. This figure was ornamented with gold to the amount of forty talents, according to Thucydides, or about £120,000 sterling, of which, however, it was stripped by Lacharès, somewhat more than a century and a quarter after the death of Periklès.

Probably the words of Fergusson, the eminent architectural historian, are not overstrained, when in respect to this exquisite work he says, "For beauty of detail, and for the exquisite perception of the highest and most recondite principles of art ever applied to architecture, it stands utterly and entirely alone and unrivalled—the glory of Greece." The famous frieze, so much of which we have the privilege to possess at the British Museum, represented the full glory of the Panathenæic festival, and is crowded with splendid figures of men and of horses: it ran all round the outer wall of the cella, close up to the ceiling; and its total length was 525 feet. Every year or so fragments of the frieze, or of the similar bas-reliefs of the metopes, such as heads or limbs, or even pieces of the large slabs with figures on them, are unearthed in continental libraries and museums by the diligence of our archaeologists; casts are taken, and our own specimens thus restored and completed, care being always observed to distinguish the restored from the original parts.

The best work specially on the sculptures of the Parthenon is that of Michaelis (Leipzig, 1871); but by far the best book on the entire subject is that of Fergusson (London, 1883), the more valuable since, starting from the Parthenon, the author is able to include what is really a comprehensive treatise on the various modes of roofing and lighting employed in the temples of the Greeks—a very difficult problem, certainly not dealt with satisfactorily by any of the numerous archaeologists who had hitherto discussed the subject. Mr. Fergusson's aim in this respect, on which he has expended much study both of historical evidence and of the buildings themselves, aided in no small

degree by his practical knowledge of architecture—is to combat the old and once universally accepted theory of the "hole-in-the-roof" (hypæthrum) method of lighting the cella, with its statue of the deity to whom the temple was consecrated. From the universally known example of the Parthenon he is able to show that light was far more probably, in fact almost certainly, obtained by the inner walls of the building rising higher than the outer, like the nave of a cathedral or basilica which overtops the aisles; and this free wall-space above the aisles being pierced with arches becomes a clearstorey, admitting light and air. Projecting eaves would keep out the rain quite well.

The columns seen in the illustration are the peristyle, the cella or actual temple lying within them. This cella was cut into two chambers of unequal size, the sanctuary (*prodomos*), with the wonderful statue of the goddess, and the inner chamber (*opisthodomos*), probably a vestry for the priests, &c. The whole building was adorned with colour and gilding—long since perished beyond conjecture. The triangular pediments or gable ends (one is shown in the sketch) were filled with splendid groups of statues by Pheidias, many of them in the British Museum, the metopes (the square spaces seen beneath the pediment) were filled with pictures of the battle of the Lapithæ with the Centaurs.

PARTHENOPEAN REPUBLIC, the name given to the kingdom of Naples when forcibly converted into a republic by Championnet, the general of the French Directory, 23rd January, 1799. It was dissolved only five months later, 20th June, 1799.

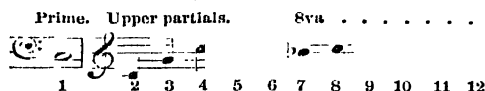
PARTHIA originally comprised a small and mountainous country south-east of the Caspian Sea, between Hyrcania and Aria; but the name was sometimes applied to the countries included in the later Parthian Empire. The chief town of Parthia, and the only one of any importance, was Hekatompolis. Quintus Curtius says that it was founded by the Greeks; but the name, which is Greek ("the hundred-gated"), is probably only a translation of a native word. The site of it is doubtful.

The Parthians were of Scythian origin, and were subject to the Persian monarchy. Under Alexander Parthia and Hyrcania together formed a satrapy, which also appears to have been the case under the Syrian kings.

On the death of Alexander, the Parthians espoused the side of Eumenes, and afterwards became subject successively to Antigonos and the Seleukidæ till about B.C. 256, when they threw off the authority of the Syrian monarchs and were formed into an independent kingdom under the rule of Arsakès I., from whom the succeeding kings received the title of Arsakidæ. This was the beginning of the Parthian Empire, which at length extended from the Euphrates to the Indus, and from the Oxus to the Persian Gulf, and lasted from B.C. 256 to A.D. 226. Its history may be divided into three periods:—the first period, from B.C. 256 to B.C. 130; the second, from B.C. 130 to B.C. 53, at the close of which the Parthians came into contact with the Romans; and the third, from B.C. 53 to A.D. 226, comprehending the wars with the Romans. The last king of Parthia was Artabanos. Artabân (Artaxerxes), who served in his army and called himself a descendant of the ancient kings of Persia, usurped the dominions of the Parthian kings, and founded the new Persian Empire, usually called that of the Sassanidæ.

PARTIAL TONES, the sounds of which every usual musical tone is made up, and which occur in a series of notes bearing the relation to the prime or starting point of 1, 2, 3, 4, 5, 6, &c., if the respective numbers of the vibrations per second necessary to produce them be considered. Thus if the prime or first partial needs 256 vibrations per second, the second partial will need 512, the third 768, and so on for other partials. The whole series is also called the harmonic series. It may be represented in notes thus—the seventh partial (harmonic Seventh) being flatter than the

modified minor Seventh used in our scale, and the eleventh partial (harmonic Fourth) being sharper than the Fourth or subdominant of the scale—



This series is often divided (rather dangerously) into the Prime 1, and *Upper partials* 2, 3, 4, &c., and the latter (still more dangerously) are sometimes called *Overtones*. The prime is the first partial, and had better always be so regarded.

The reason of the notes of this harmonic series being called partial tones, is that, except a very few tones of special simplicity, every musical tone is in reality a chord made up of notes of this series, each note being therefore a part of the whole compound tone, which affects the ear as being at the pitch of the prime or first partial; that is to say, the upper partials melt into the prime and modify its tone-colour or *quality*, though they do not affect its pitch. A violin and a human voice have the whole series up to 8 or 10; that is, each apparently single note they play or sing is really a chord of 8 or 10 simultaneous sounds. A pianoforte has the series up to 7 or 8. A trumpet has the first partials weak and the high partials strong, whence its shrill "blare." Other instruments have other peculiarities. Stopped organ-pipes and clarionets have only the partials 1, 3, 5, 7, 9; and some stopped organ-pipes have only the first three of this series. No two varieties of instruments have the same relative strength of partials, and it is purely this diversity which gives all the varied tones of the orchestra. But more, each instrument differs from each other of its own class—no two fiddles, no two trumpets, no two voices are quite alike throughout; and all these differences arise from one or more of the series of partials being stronger or weaker for one instrument than for the other. The slightest shade of deviation in relative force makes a difference in the quality of the tone which the partials combine to produce. But their order never varies from that given above.

PARTICIPLE, in grammar, the name of the adjectival element of the verb. The word "participle" comes from the Latin word *participium*, and means literally "part-taking." The English verb has only two participles, which are usually called present and past. The present participle ends in *ing*, but it originally ended in *and*, which is the same termination as occurs in the cognate languages, namely, *ant* in the Sanskrit; *ont* in the Greek, as *lapt-ont-os*; *ent* in the Latin, as *reg-ent-is*; and *end* in the German, as *lieb-ent*. The other participle in English is used to denote past time, and is generally formed by adding *en* or *ed* or *d* to the verbal root, which, however, frequently undergoes a modification, as *brok-en*, *praise-d*. The final *d* of the participle often becomes a *t*, as *feel*, *felt*. It is remarkable how many French nouns have been formed from Latin participles; as *issue*, *rue*, *dette*, *réponse*, *regu*, *fait*, and a great many more; and, as the two last (quite recent) examples show, the language has retained the power of coining fresh words in the same manner.

PARTICLE, which is derived from a Latin word (*particula*) meaning a small part, is a term employed in grammar. Some of the old grammarians included under this name all the parts of speech except the verb and the noun, namely, prepositions, adverbs, conjunctions, and interjections. It is now more general to consider only such small words as the Teutonic *a*, *be*, *for*, &c., or the Classical *circum*, *con*, *de*, &c., as particles. They melt into the words to which they are prefixed or affixed, and cannot always be rendered in another language by corresponding equivalents. It is necessary to represent their force and meaning by regarding the compound as a new and separate word. Examples

of the above-named particles in composition are—alight, adown, athirst, bespeak, forgive, circumstance, condition, depart, &c.

PARTICULARISTS, a sect of the Reformed Church, dating from the Synod of Dort, whose members maintain the doctrine of particular salvation and punishment, or election. This Calvinistic dogma is also held by the Particular Baptists.

PARTISAN (Fr. *partisane*, from Lat. *pertundo*, I thrust through), the name of a kind of pike, consisting of a long blade at the end of a stout staff, which was introduced into European warfare during the reign of Edward IV. It was at first much used as a weapon for infantry, but ultimately it was modified into an ornamental halberd which was carried only by body-guards.

PARTITA, an Italian equivalent for the French *suite* as a musical form, each of them applying to a collection of movements in the various dance-rhythms of the period classically treated. Bach's three partitas are especially fine. That composer also uses the word elsewhere as synonyms with the old "divisions," or what we now call "variations." In a certain sense the partita was a predecessor of the sonata and symphony, which always at first contained a minuet, and usually a rondo in addition. A partita always opened with a formal introduction or prelude, and usually contained some of the following:—allemande, courante, passepied, sarabande, bourrée or gavotte, giga, &c.; frequently a touching aria would pleasingly break the succession of dance-rhythms.

PARTITUR (German) and **PARTITION** (French) are musical terms which represent what in English we call the **SCORE**.

PARTNERSHIP. It is not easy to give an exhaustive definition of what is implied in this term, but generally speaking, if two or more persons join together their money, goods, labour, and skill, or any or all of them, for the purpose of a common undertaking and the acquisition of a common profit, that is a partnership. The object of the partnership may be anything that is lawful, but any agreement of partnership for an unlawful object is not valid. The English law of partnership, like that of most European nations, is based on the Roman law, but in England the law is modified by the so-called law of merchants and the common law. No writing is necessary to constitute a partnership; the acts of the parties, when there is no partnership contract in writing, are the evidence of the contract. Partners may be either ostensible or dormant. He who allows his name to appear to the world as a partner, is an ostensible partner, and though he may have no interest in the concern, it is an established principle in law that such a person incurs the liability of a partner. A dormant partner is one whose name does not appear to the world as one of the firm. A dormant partner is liable like an ostensible partner for the engagements of the firm; even to those who, when they contracted with the firm, were ignorant of his existence. If, however, the ostensible partners have been sued to judgment, an action cannot be brought to charge the dormant partner. Dormant partners are equally bound by express as by implied contracts in accordance with the principle that, as they share the profits, so they ought to share the liabilities. Formerly any number of persons might be partners, but by the Companies Act of 1862, not more than ten persons can carry on the business of bankers, and not more than twenty any other business unless (with certain exceptions) they conform to the provisions of the Act.

Any person of sound mind and not under any legal disability may be a partner. An infant may enter into this, as into any other trading contract which may possibly turn out to his advantage. It may, however, be avoided by him on coming of age, though the person with whom he contracts, if of age, is bound by it. Formerly married women were

incapacitated from entering into the contract of partnership, and although they might be entitled to shares in banking houses and other mercantile concerns, yet in these cases their husbands were entitled to such shares and to become partners; but it is presumed that this disability was extinguished by the Married Women's Property Act of 1882. If persons share in the profit and loss they are partners, although one may bring into the trade money, another goods, and a third labour and skill, which was also the rule of the Roman law; and where one party is sole owner of goods and another sole disposer or manager of them, if they share the profits they are partners. Subject to the limitations noticed below, every person who has a share of the profits of a trade must also bear his share of the loss; for a right to a share of the profit implies a liability to bear a share of the loss. Yet one partner may stipulate with the other partners to be free from all liability to loss, and such stipulation will hold good between himself and his partners, though he will still be liable to all those who have dealt with the firm of which he is a member. No change can be made in the nature of the partnership, except with the consent of all the partners. The division of profits between or among partners may be in any proportions that they agree upon. To constitute a man a partner on the ground of sharing profits, he must have an interest in the profits as a principal in the firm; if he only receive a portion of the profits, by way of payment for his labour, trouble, or skill as a servant or agent of the concern, he is not a partner.

A partnership at will is one which continues as long as the parties live and are able and willing to continue it; a partnership for a fixed term continues for the term, if the parties live and are of legal capacity to continue it. A partnership at will may be dissolved at any time by the expressed will of any member of it, a rule which is derived from the Roman law, and which is a necessary consequence of the nature of the partnership contract. The effect of such dissolution is to stop all new partnership dealings or contracts; but the partnership still continues for the purpose of completing all contracts already made, and all dealings or undertakings already commenced. On such dissolution, any partner is entitled to have the whole partnership stock, and the interest in the premises in which the business is carried on, converted into money, and to receive his share of the produce. In all cases, by the natural death of a partner, the partnership is dissolved, a rule also derived from the Roman law. It is also dissolved by a partner's civil death, as his outlawry or attainder for treason or felony; and strictly speaking, the whole property is forfeited to the crown, for the king never becomes joint-tenant or tenant in common with the other partner, and he is entitled to the whole. This right, however, is seldom enforced against creditors or innocent partners. A partnership for a term may be dissolved before its expiration by the mutual consent of the parties, or by the bankruptcy, outlawry, or felony of any of the partners. When a partner so conducts himself in relation to the partnership business that it is not reasonably practicable for the other partner or partners to carry on the business in partnership with him, the partnership may be dissolved by the High Court; and the courts will in some cases dissolve a partnership on the ground of incurable insanity in one of the members. A partner may agree that upon his death the business may be carried on beyond the legal period of dissolution, in the hands of his children or other third parties, but this is properly an agreement for a new partnership. Partners cannot be relieved from future liabilities to third parties without notice to them and to the world in general that the partnership has ceased; but in the case of a dormant partner, if none of the creditors know that he is a partner, no notice of his retirement from the firm is necessary; and if it be known to some,

notice to such only will be sufficient. On the death of a partner, notice of the dissolution to third parties is unnecessary. This is a general description of the nature of partnership. The rules of partnership are very numerous, and belong to a legal treatise.

The legislature, following out the principle of limited liability, by the 28 & 29 Vict. c. 86 (1865), enacted that the advance of money by way of loan to a person engaged or about to engage in any trade or undertaking, upon a contract in writing with such person that the lender should receive a rate of interest varying with the profits, or should receive a share of the profits, should not constitute the lender a partner. Further, that no contract for the remuneration of a servant or agent, by giving him a share of the profits, should render him a partner. That the widow or child of any deceased partner of a trader, and receiving by way of annuity a portion of the profits, should not be deemed a partner. That no person receiving by way of annuity, or otherwise, a portion of the profits of any business in consideration of the sale by him of the goodwill of the business should be deemed a partner. In all these cases the parties are in no way subject to the liabilities of the person carrying on the business. If, however, the trader should be adjudged bankrupt, or enter into an arrangement to pay his creditors less than twenty shillings in the pound, or die in insolvent circumstances, the lender of the loan or the vendor of a goodwill shall not be entitled to payment of the money lent in the one case or the profits of the other until the creditors of the trader are satisfied. The word "person" in the Act includes a partnership firm, a joint-stock company, and a corporation.

There is a fundamental distinction between the law of England and that of Scotland as regards a partnership, for whereas in the former country the firm is regarded simply as a collection of individuals—any person who has any rights against the firm possessing them in reality against its members; in Scotland the firm is a separate person, or rather *quasi* person, so that even its own members may sue it. This peculiarity in Scotch law—which, indeed, it shares with most continental systems—renders it dangerous to follow English precedents in matters of form, though it seldom affects the general principles of the law, which may be said to be nearly the same in both countries. Whatever may have been the earlier doctrine it has long since been conclusively fixed in Scotland that the *quasi* person of a mere copartnership or firm is something very different from the proper *persona* of a corporation, which can be established by public authority only. A corporation possesses a name or title by which it can sue and be sued; a copartnership has no such name, but must sue and be sued in the names of its partners, or of three of them at least, if its membership amount to so many. A corporation confers the benefits of limited liability, unless the incorporating instrument otherwise provide; by no device short of incorporation can a mere partnership attain limited liability either as regards itself or the members composing it. A corporation holds property in its corporate name, a partnership through trustees. The latter does not possess a common seal. A corporation possesses endless succession *ex natura*; a partnership may at any time be dissolved by the will of its members, unless it has been otherwise provided in the contract. If due attention be given to these considerations it will be seen that the Scottish theory of the separate *quasi persona* of the firm, though of considerable technical importance, cuts less deeply into the general principles of the law, received alike in England and Scotland, than has sometimes been supposed. It is much to be regretted, however, that any such technical difference should exist between the two systems. See Clark on "Partnership and Joint-stock Companies."

On partnerships in banks and joint-stock companies, see BANK and JOINT-STOCK COMPANY. In 1837 a statute

was passed (7 Will. IV. & 1 Vict. c. 73) authorizing the crown, after a reference of an application to the Board of Trade, to grant a species of incorporation to trading companies by letters patent under the great seal. The patent may limit the responsibility of partners to a certain sum per share. The law of joint-stock companies (limited), under the Act of 1862, has been already treated on. The mode in which property in ships is held by part-owners is explained in SHIPS.

The great extension of English industry and commerce has been accompanied by the growth of a large mass of law applicable to the contract of partnership, a great part of which has been made by the decisions of the courts on such cases as have been litigated. A very trustworthy guide to the law on this subject will be found in "A Digest of the Law of Partnership," by Mr. Frederick Pollock (London, 1877).

PARTRIDGE is the name given to several species of game birds belonging to the *Perdix*inae, a subfamily of *Tetraonidae*. The Common or Gray Partridge (*Perdix cinerea*) is one of the best known birds in the British Isles, its numbers increasing with the improvement in agriculture. It has long been pre-eminent as a game bird. The old method of partridge shooting, with the aid of pointers and setters, has now been superseded by "driving," a change partly induced by improved methods of cultivation, but partly also by the desire of big "bags."

Partridges are generally met with about corn-fields, where they feed upon seeds, tender herbage, slugs, and cts, especially the larvae and pupae of ants. They pair early in the spring, and the female deposits from twelve to twenty eggs of an olive-brown colour, in a small hollow scratched in the ground and lined with a little straw. The period of incubation, which occupies three weeks, is left entirely to the female, although the male is assiduous in his attendance upon his mate, and endeavours to protect her from any danger. The young when hatched accompany their parents in search of food, and the small parties thus formed, known as *coveys* by sportsmen, keep together throughout the autumn and winter, if not destroyed by the gun. The parent birds display much courage and resource in defending their young brood from their natural enemies. The flight of the partridge is rapid, direct, and low. The male bird is 12½ inches in length, the female a little smaller. The plumage of the upper surface is brown of various shades from an ashy-gray to a rich chestnut; the sides and flanks are barred with chestnut; the male has a horse-shoe-shaped patch on the breast of a rich chestnut colour, which is not assumed by the female till the second or third year. Great variation of colour is found among partridges, some being wholly white. Partridges may be readily tamed, but do not breed in confinement. The common partridge is extensively distributed throughout the British Isles, but is not known in the outer Orkneys. It is abundant in Northern and Central Europe, giving way in the south to the red-legged partridge; it is, however, found in Italy as far South as Naples. In Asia it is unknown, being replaced in Eastern Siberia by *Perdix barbata*.

The Red-Legged or Guernsey Partridge (*Caccabis rufa*) is distinguished by having the tarsi in the male armed with blunt spurs. It is a handsome bird, and rather larger than the common or gray partridge. It is of a brown colour above, pearl gray on the breast, and fawn colour on the belly; the throat is white, and surrounded by a broad black gorget, below which numerous black streaks and spots descend towards the breast, and the feathers of the flanks are beautifully adorned with transverse bars of pearl gray, white, black, and fawn colour. The bill and legs are bright red. This bird is a native of Southern Europe, and was introduced into Britain in 1770. It has now become abundant in our preserves; but sportsmen are

prejudiced against it, from the mistaken idea that it drives away the gray partridge, from its habit of running before the dogs instead of rising, and from its wildness and strength of wing. Though called the Guernsey partridge it is extinct in the Channel Islands even as an introduced species. In its habits it resembles the common species. Several other species of the genus *Caccabis* are known in Southern Europe (*Caccabis aurealis*), in North Africa (*Caccabis petrosa*), and in India. The Snow Partridges (*Tetraogallus*) are found in the mountain ranges of Central Asia.

In America the name partridge is used loosely for game birds unconnected with the subfamily *Perdix*inae; thus the partridge of New England is the Ruffed Grouse (*Bonasia umbellus*); the partridge of the middle and southern states is the Virginian Quail (*Ortyx virginianus*).

PARTS, in music; *Part-writing*; *Progression of parts*. In concerted music each note of a chord is reckoned as a note of a part (or voice), and the entire part is composed of the notes holding similar relations of position in each successive chord. The treble part, for instance, runs along the treble notes of the harmony, the bass part is made up of the bass notes, &c. This notion of parts of course arises from the time when the chief instruments were human voices, and harmonized chords were made up of the blending of separate parts. Now, the notion is not so clearly perceivable in practice, where instrumental music is concerned, and especially with the pianoforte, where single notes and full chords are mixed together entirely at the discretion of the composer. Nevertheless, to understand the rules which govern this apparent chaos it is necessary for every one who would write clearly and grammatically to study part-writing for the simple quartet of voices.

It will be at once found that it is not sufficient to secure a pleasing succession of chords, the motion of the individual parts must be also harmonious. In the old times this motion was limited by the rules of counterpoint, which tended towards the production of individual melodies and against the sacrifice of interest in each part; but in modern times this "horizontal view" of musical scores, as it has been happily termed, has largely, too largely, given way to the "vertical view," that is, to the view of harmony, the whole musical framework being regarded as built up of successions of harmonies. The first is comparable to small companies of men, each marching by parallel paths to a common goal; the second to a dense battalion moving with one step in one great mass. Nevertheless even masses of harmony must have the inner motion of their parts smooth, though it be often uninteresting; one chord must proceed in an orderly fashion to the next, and not arrive by a sudden jump at the new harmony.

In this way we arrive at the following few well-known principal rules:—

A part should not proceed, as a general rule, by an augmented or diminished interval, because the connection of the part is thereby broken. The chief cases where such a progression gives a good effect are (1) in a sequence, (2) in the resolution of the minor Ninth, (3) in passages relating to the minor scale, (4) in an arpeggio containing such intervals. Diminished intervals should be followed by a note within the interval.

Two parts should not move in consecutive (perfect) Fifths or Octaves with each other; and the extreme parts, as for instance the treble and bass of a quartet, should not even arrive at a Fifth or an Octave by motion in the same direction, an effect often called "hidden consecutives." Hidden Fifths or Octaves are not, however, offensive among the inner parts. It is only in appearance that doubling, i.e. playing or singing in octaves throughout a piece or a part of a piece, as in the orchestra, in unison singing, &c., breaks the prohibition against consecutives, because a moment's consideration will show that such passages are

not passages of harmony at all; they partake of the nature of melody—the octave is really an added **PARTIAL TONE**, brightening the prime, not another part written in harmony with it. Indeed this is no doubt the philosophical cause of the bad effect of consecutive octaves; that we find ourselves suddenly deprived of a part, and at the same time we find another part quite altered and brightened in its quality, so that it tells out against all the rest and spoils the balance of the harmony. Consecutive Seconds, Sevenths, Ninths, &c., are also forbidden, because the necessary resolution for each one is evidently impossible to obtain in such a sequence.

Another rule is that no part should proceed in Fourths with the bass, though Fourths among the upper parts are not at all objectionable.

The only other main direction we need notice is that the leading note, the Seventh of the scale, should always rise, though it need not always rise to the keynote, except in a full close. Cases where it does not rise are (1) in sequences, (2) in passages of a descending bass, which are in fact portions of a scale, and (3) in a mere shifting of position without alteration of chord.

Doubling the leading note of the scale is forbidden, and so also nearly always is doubling the Seventh in a chord, or the Ninth when that occurs, or any other discord; and it is always desirable not to double the major Third when this occurs as the bass of a chord of the Sixth, because of its powerful colour. **FALSE RELATION**, which is elsewhere explained, is of course quite forbidden.

Part-writing, in which the parts lie rather closer together in the upper parts than between these and the bass, is always richer and more harmonious than when the bass is thick. On the other hand, if the bass gets too far away from the rest the chord becomes thin. As a general rule, it is always best to let the parts move as little as possible, and if one note is common to two adjacent chords, to let it occur in the same part in each. In this way smoothness of passage is obtained, and the whole composition becomes firmly knit together. It is forbidden also to let the parts cross (though this rule is too often broken), for the simple reason that the mind is no longer able to follow their simultaneous careers with facility. A tenor who has gone below the bass for a moment has become for that moment a bass, and is so heard by the ear, to its confusion.

PARTS OF SPEECH, the verb, noun, adjective, adverb, article, preposition, pronoun, conjunction, and interjection, into which the words of a language are divided or parted out by grammarians. They are mostly treated of under their respective headings in the present work. See also the articles **ETYMOLOGY**, **GRAMMAR**, **LANGUAGE**.

PART-SONG, a simple composition for three or more voices, frequently without instrumental accompaniment. It differs from the glee in being for many voices to a part, and in being in one movement; and it differs from the madrigal, which it resembles in these last-named particulars, because while the madrigal is essentially a polyphonic composition, each voice being equally interesting and important, and therefore every device of counterpoint being not only admissible but desirable, the part-song moves in definite rhythms, like the simple rhymed poetry to which it is generally set, the other voices are quite subordinate to the treble, and harmony, not counterpoint, governs the composition. The madrigal is a collection of melodies forming harmony as they intertwine; the part-song is a succession of chords with a melody at the top. It is evident, therefore, that the simplicity and consequent ease of this branch of concerted music renders it eminently suited to the needs of those who have not good voices enough to sing glees nor knowledge of music enough to sing madrigals. Nevertheless, it is a pity to see England, the chosen home of madrigal and glee, so utterly abandoning these higher forms for that of the part-song as at present is the case. But with advancing knowledge a taste for the higher styles must arise.

PARTY GOVERNMENT, in England, can be traced back to the close of the time of Elizabeth, when the Puritan party took up a clear stand as the opposition to the queen's government. This developed rapidly under James I. into the people's party, aiming at freedom, and the king's party, supporting the theory of the divine right of kings. A sharper line still divided the Roundheads and Cavaliers of Charles I., and party nicknames, it is observable, had now begun in full force.

The Restoration (1660) found men all of one mind, tired of the long dissension; but by 1679 the question of the religion of the heir-apparent (the Duke of York, afterwards James II.) revived the old parties; and when the Exclusion Bill, for shutting out James from the succession as a Roman Catholic, was demanded by large bodies of the people, the parties of *petitioners* (for a new Parliament to debate the question) and *abhorres* (of apparent dictation to the king as to when he should call Parliament) practically represented the old Roundheads and Cavaliers. Very soon afterwards these parties received the name of Whigs and Tories respectively, and tended as of old to fight for the power of the people on the one hand, and the power of the crown on the other. After 1688 the extreme Tories held on as Jacobites until about 1715; after that time they rejoined the main Tory body. Between 1693 and 1696 William III. chose his ministers (the *Junto*) consistently from the Whigs, but they refused to resign in 1698 when the elections went against them, and it is therefore evident that the final principle of party government was not yet attained.

We may consider party government, in its present sense, as a division of the Parliament, and more especially of the House of Commons, into two great bodies of Whigs and Tories (or their modern successors, Liberals and Conservatives), the party in the majority having the control of the executive government, to date from the reign of George I. By the close of that reign it was clearly establishing itself, and it is now so rooted as a principle with us that we can hardly conceive any other. The great value in the system lies in the fact of the incessant watchfulness over all acts of the government kept up by the Opposition. Any stretch of prerogative or other illegality, any blunder of policy, or failure or undue exercise of authority on the part of the government is at once denounced, and used as a lever to overthrow the ministry for their punishment.

PARTY WALL. Under the Metropolitan Building Act the meaning of "party wall" is defined to be every wall used, or built in order to be used, as a separation of any building from any other building, with a view to these buildings being occupied by different persons. The regulations applicable to the building of party walls are contained in the above Act. In Scotland a party wall is termed mutual wall or gable. It is possible that a party wall may be built wholly on the land of one of the neighbours, in which case it belongs to him, but his neighbour acquires a right of easement over it by long use. Generally, however, the wall is built at the joint expense, and equally upon the land of the two neighbours; and in the absence of any proof to the contrary this is always assumed to be the case. Each neighbour theoretically has the right to remove his half of the wall up to the term of twenty years from its building, by which time his neighbour will have acquired rights of support; but in practice it would be difficult, and often impossible successfully, to assert the exercise of this right.

PASCAL, BLAISE, was born at Clermont in Auvergne, 9th June, 1623. He was the only son of Etienne Pascal, president of the Court of Aids in that province, himself a learned and respectable man and able mathematician, who, when his boy had reached his eighth year, resigned his office and removed to Paris, for the purpose of watching over his education. At sixteen years

of age Pascal produced a treatise on the conic sections, of such excellence as to provoke the incredulity and wonder of Descartes. In his nineteenth year he invented an ingenious machine for making arithmetical calculations; and when he was twenty-four years of age the conjecture of Torricelli, that the atmosphere had weight, and that this quality might account for effects before ascribed to "Nature's horror of a vacuum," led him to institute many experiments on this subject, which confirmed the truth of Torricelli's idea, and established his own scientific reputation. The results of these labours were collected into two essays, which appeared after his death, "On the Equilibrium of Liquids," and "On the Weight of the Atmosphere." From these researches the mind of Pascal passed to objects of religious contemplation, and thenceforward he abandoned almost entirely the pursuits of science. While immersed in the most rigid religious observances, he published his celebrated "Provincial Letters," in which, under the name of Louis de Montalte, he assailed the tenets of the Jesuits with equal wit and argumentative acumen. He was induced to write this work by his adoption of the opinions of the Jansenists, which involved him in the religious disputes of his age and country. Pascal often gave twenty days to the composition of a single letter, and some of these letters he wrote and rewrote seven or eight times. The result is, that they are reckoned among the best specimens of the grace and flexibility of the French tongue at its greatest epoch. The best edition of the "Lettres Provinciales," certainly Pascal's finest work, is that of 1867, the fine edition of Berome (1886) sinning by the fault of "taking sides." The full title of them is "Lettres écrites par Louis de Montalte à un provincial de ses amis, et aux révérends pères Jésuites, sur le sujet de la Morale et de la Politique de ces pères." It is not too much to say that these letters delivered a blow at the Jesuits from which they have never wholly recovered, and never can recover. The originality of the argument, the keenness of the prevailing irony, the satire, fine and trenchant, are even yet unapproachable. Pascal never thunders at his foes, he gently points out, as if with a pleasant smile, most gallingly in its perfect good breeding, their absurdities and contradictions. Very rarely, indeed, does he drop the graceful mask of irony. The only author at all comparable with Pascal for power of ironical writing is Swift, and that is to compare a broadsword with the finest rapier ever turned out of Toledo. Swift cleaves asunder, and we marvel at the force; we shudder at the executioner and pity the victim. Pascal transfixes his adversary so politely that we are almost oblivious of the deadly thrust in our admiration of the wonderful skill at fence displayed, and must love the man for his imperturbable good humour. The *Provinciales* were published by Pascal himself (anonymously), and were completed in 1656.

The other chief work of Pascal, the famous "Pensées," scattered religious meditations and reflections, probably the materials for a work never cast into its final mould, though perhaps more popular, is certainly of not at all the same value. What it might have developed into we cannot say: the loose papers were found in his desk, and were shamefully mutilated and garbled in publication. They have only of late years been painfully restored to their original condition. The best edition of the "Pensées" is that of Rochemore. 1873. They were excellently translated into English as the "Thoughts of Blaise Pascal," by C. Kegan Paul, in 1885.

Pascal died on the 19th of August, 1662, having lived in retirement, indulging in ascetic practices and whole sale almsgiving, spending his time entirely in religious mathematical, and philosophic meditations.

PASCAL'S THEOREM, a well-known theorem on conic sections, so called because first enunciated by Blaise Pascal, as follows:—The intersections of the three pairs of opposite sides of any hexagon inscribed in a conic section

lie in a right line. This right line is called a *Pascal line*. The original theorem, on which the author is said to have based the entire theory of conic sections, occurs in his "Essai sur les Coniques," published by him in his sixteenth year.

PAS-CHAL was the name of two of the popes.

PASCHAL I. (817–824), a Roman, is remarkable for the circumstance that he was elected by the people of Rome, and without the emperor's sanction. He at once submitted himself, however, to Kaiser Ludwig. In 824 the emperor's son Lothar was seized at the Lateran by ruffians, who put out his eyes and afterwards beheaded him. Paschal declared his own innocence, but it is remarkable that he shielded the murderers. What the people of Rome thought of it at the time is signified by their refusal to bury him in St. Peter's. After-ages gave a more favourable interpretation to the Pope's conduct, and he received the honour of canonization. Paschal I. followed Stephen IV. and preceded Eugenius II.

PASCHAL II. (1099–1118), a Tuscan, assumed the name, his family name being Rainieri. He was known as one of the finest of the Cluny monks, and Hildebrand (Gregory VII.), who had been a monk himself, and always remained one at heart, made him a cardinal in 1076. On his election to the papacy, Paschal at once carried forward the vigorous church policy of his great patron. But where Gregory had succeeded Paschal failed. He endeavoured, and not without success, to use Henry the son of the Emperor Henry IV. as a means of attack against his father; but when the prince himself succeeded to the empire as Henry V. (1106) he proved all the more dangerous as an opponent of papal claims in that he knew them from within. Henry at once proceeded to exercise to the full every imperial pretension; and finally cowed the Pope by the threat of restoring order in Italy. Paschal offered to yield up all the Papal States if the imperial claim to appoint prelates (*investiture*) were relinquished. Henry agreed, but on his arrival in Rome difficulties were thrown in the way. He had to remove the Pope and cardinals from the city for two months, in a kind of temporary exile, before he could get crowned; and he then withdrew from Italy, considering the long quarrel to be at an end. A Lateran council (1112) repudiated the settlement, however. When the great Countess Matilda bequeathed her vast possessions to the church, Henry proceeded accordingly to occupy them, and on the Pope's resistance, he was driven out by the imperial army (1115), and retreated as far as Benevento. When the army retired again across the Alps, Paschal returned to Rome (1118), but died almost immediately. He succeeded Urban II. and preceded Gelasius II.

Paschal III. was the name taken by the Cardinal Guido of Crema, who succeeded the so-called Victor IV. in 1164, as the nominee of the Emperor Frederick Barbarossa against Pope Alexander III. The latter was forced for some time to take refuge in France, whence he and Thomas A'Becket fought the battles of the church: Paschal, with the emperor's help, possessed Rome. In 1168 Alexander was strong enough to return to Rome; the emperor did not feel safe in Italy and retired. The cause of the anti-pope was already lost, even had he not died at the close of the year, maintaining himself in Rome to the last. At his death no cardinal remained faithful to him, and the Bishop of Tusculum took the title of Calixtus III. But the schism was over: Alexander III. was triumphant.

PAS-DE-CALAIS, a department in France, formed out of almost the whole of Artois and some portions of Lower Picardy, bounded E. and N.E. by the department of Nord, N.W. and W. by the Straits of Dover and the English Channel, and S. by the department of Somme. From N.W. to S.E. it is 86 miles long, and its mean breadth is 33 miles. The area is 2551 square miles, and the population in 1832 was 819,022.

General Aspect and Hydrography.—The department takes its name from *Passage* or *Pas* de Calais, by which the French sometimes designate the Straits of Dover. It consists of two inclined plains, which slope respectively towards the east and west, and lie on either side of a ridge of hills that crosses the department from south-east to north-west, terminating in the latter direction in the high cliffs of Cape Griznez, between Calais and Boulogne. These cliffs, which extend for some miles on each side of the cape, are composed of chalk, and bear a close resemblance to those of Dover. In some other parts the coast is low, and defended from the sea by a natural barrier of sandy downs. The coast-line, reckoning all its indentations, has a length of about 80 miles, but it presents no good natural harbours, the inlets being encumbered with sand or the debris of the cliffs. Calais and Boulogne are artificial high-water harbours formed by piers. The principal rivers on the eastern slope are—the Scapue, the Senece, and the Lys, feeders of the Escaut, and the Aa, which forms the north-eastern boundary and falls into the sea at Gravelines; all these rivers are navigable, and connected by canals. From the western slope flow the Liane and the Canche into the channel at Boulogne and Étaples respectively, and the Authie, which flows for some way in the department of Somme, and then north-west into the channel, forming the boundary between Pas-de-Calais and Somme. By means of its rivers and several canals that connect the principal towns on the eastern slope with those of the department of Nord, Pas-de-Calais has an inland navigation of 121 miles. It is traversed also by the Lille-Calais and the Amiens-Boulogne railways, both of which are united by the Great North of France line, through Arras, to the railway systems of France and Belgium.

Soil and Climate.—The soil is in general fertile; farms are large; a very great breadth of land is sown with wheat and oats; but other cereal grains, pulse, oleaginous seeds, and cider fruits are also grown. The low valleys are in many places marshy, and in some places covered with peat bogs. A great deal of land is laid out in meadows and orchards, and agriculture is generally in a very advanced state. The breed of horses and sheep is superior, but the cattle are indifferent. Other crops besides those already named are barley, beet-root for making sugar, hemp, flax, tobacco, flax, and hops. The number of horses chiefly for draught, of horned cattle, sheep, and swine, is very great; poultry is abundant, good, and cheap; and fish is plentiful, great numbers of boats being actively engaged in herring, cod, mackerel, and oyster fishing. The climate is remarkably healthy, resembling that of the south-east of England, but is, if possible, more inclement, the changes from heat to cold being sometimes marked by great rapidity; the west and north-west winds, charged with sea spray, are sometimes very annoying on the coast.

Products and Resources.—Iron and coal mines are worked, about 5,000,000 tons of the latter being raised every year. Other minerals are marble, quartz, rock-crystal, limestone, turf slate, and pipe and potter's clay. The industrial products of the department are—common woollen cloth, hosiery of all kinds, velvet, lace, thread, beet-root sugar, cotton and flaxen yarn, beer, tobacco, oil, salt, gin, grain and potato spirits, furniture and cabinet work, glass, earthenware, &c. There are altogether ninety sugar manufactories, producing about 70,000 tons annually; and thirty distilleries, at which more than 3,000,000 gallons of spirit are made every year; in addition to which the department contains many breweries; tobacco factories, more than 3,000,000 lbs. being grown in the department annually; ironworks, &c. The coasting trade in corn, eggs, butter, seeds, oil, flax, hides, &c., is active. Steamboats ply regularly between London, Dover, and Folkestone, to Calais and Boulogne.

The department is divided into the six arrondissements

of Arras, Béthune, St. Omer, St. Pol, Boulogne, and Montreuil. The chief town is ARRAS.

PAS'ENG. See *ÉGAGRE*.

PASIG'RAPHY (Gr. *pas*, all, and *graphô*, I write), a universal language to be adopted by all nations, to promote the free intercommunication of ideas. Many powerful minds have exercised their ingenuity in the attempt to give form and substance to this chimera; among others Leibnitz in Germany, and Bishop Wilkins in England.

PASIPH'Æ was the sister of Kirkê (Lat. *Circe*), and daughter of the Sun (Hélios). She married Minos, king of Crete, and was the mother of Deukaliôn, Ariadne, Phaidra, and other children, many of them among the most prominent figures in the Greek mythology. A cruel fate befel this innocent queen, against whom no word could be said. The god Poseidon, enraged at an intentional insult of Minos, afflicted Pasiphaë with a passion for a bull; and she became the mother of the Minotaur, a bull-headed man-monster of great ferocity, who devoured youths and maidens, until he was slain by Theseus, as narrated in the account of that hero. The punishment of Pasiphaë for another's guilt is one of the thousand moral enigmas which beset the inquirer into the meaning of the Greek mythology.

PASQUIER, ETIENNE, a celebrated French advocate and man of letters, was born at Paris in 1529. He studied the law, and in 1561, when the great suit between the Jesuits and the university was brought before the *parlement* of Paris, Pasquier was intrusted with the management of the cause on behalf of the university. He made a brilliant speech, which was printed and translated into various languages, and established his reputation. In 1585 Henry III. made Pasquier advocate-general to the *Chambre des Comptes*. In 1588 he was made deputy to the states-general of Blois, and there he witnessed the murder of the Duke of Guise, which he relates impartially in his letters. When Henry III. was obliged to leave Paris in possession of the League Pasquier followed him to Tours. His sons were at that time fighting in the king's army, and one of them was killed. After the surrender of Paris to Henry IV., in 1594, Pasquier continued in his office of advocate-general till 1603, when he resigned, and died at Paris in 1615. His works were published in two vols. folio, "*Œuvres d'Etienne Pasquier*" (Amsterdam, 1723). They consist chiefly of his "*Recherches sur la France*," which is an interesting work, of his "*Lettres*," and of his professional speeches. A selection of his works, by M. Léon Fèngère, with an elaborate introduction, was published at Paris, in two vols. 8vo, in 1849.

PASQUINADE (Ital. *pasquinata*), a satirical anonymous writing intended to defame or ridicule an individual. The name refers to one Pasquino, a barber of some wit and more malice, who flourished in Rome towards the close of the fifteenth century. Opposite his shop was dug up a mutilated ancient statue of Menelaos defending Patroklos, of which another copy ornaments the great square at Florence: this the authorities planted at the end of the Braschi Palace, near the Piazza Navona. Pasquino found some finger or other a convenient hanging-place for little "libels," which he affixed by night, and at which all Rome laughed in the morning. Sometimes it would be a question, but the answer would in that case be found hanging on Marforio, a statue over half an hour's walk away, down by the Forum, opposite the Mamertine Prison. Marforio, a colossal river god holding a shell, is now in the Capitoline Museum. To these statues, in imitation of Pasquino, the wits of the Eternal City for centuries were wont to affix placards, in the absence of a free press, ventilating their complaints against the government or epigrams against individuals. Pasquino, therefore, became in some measure the organ of public opinion, and there was scarcely an event upon which he did not pronounce judgment. On the election of Pope Leo X., in 1440, appeared the following

satirical acrostic, to mark the date MCCCCXI., by Pasquino, "Multi Cæci Cardinales Creaverunt Cæcum X. (decimum) Leonem" (Many blind cardinals have created a blind Leo the Tenth).

Many of the witticisms of "Pasquino" (the statue, not the identical barber whose name it bore) are really fine. Thus when the poorly-born Sixtus V. ascended the chair of St. Peter, Pasquino was found next morning dressed in dirty rags, for which he apologized "on account of his washerwoman having become a pontifical princess." It should be added that the Pope offered a rich reward for the author of the insult to his mother, and the author, who had impudence as well as wit, himself claimed it and was duly paid. But he got more than the cash for which he bargained; for Sixtus had his tongue torn out and his hands hewn off! The statue was not, however, silenced, but he presently suggested, "Poets, most holy father, are often largely paid, what will you give me to be still?" Perhaps his best epigram was that launched at Pope Urban VIII., one of the Barberini family, who was guilty of the archaeological crime of despoiling the roof of the famous Pantheon of its original Roman bronze columns, which he melted up to make the huge "baldacchino" or high altar canopy of St. Peter's. On this Pasquino remarked, "Quod non fecerunt barbari, fecerunt Barberini," which may be rendered, "That which the barbarians spared, the Barberini destroyed."

PASSACAGLIA, an Italian dance of the middle ages (*passecaille* in French), always in triple measure and upon a ground-bass, which is a short phrase repeated over and over again. This pleased the fancy of musicians and challenged their ingenuity, and therefore the *passacaglia*, though long since defunct as a dance, still exists as a very beautiful musical form. Bach has written a very celebrated one for the organ. The difference between the *passacaglia* and the *chaconne* is not easy to seize, now that both the dances are forgotten and only the music remains.

PASSAGE BEDS, in geology, are deposits, usually of small thickness, occurring between two distinct formations, and containing a few of the fossils of each mingled together: the characteristic forms of the lower beds gradually disappear, and those of the overlying strata slowly replace them. In England a good example occurs between the marine **STURIAN** rocks of Herefordshire and the overlying lacustrine strata known as the **OLD RED SANDSTONE**; another instance is afforded by the **RHÆTIC BEDS**, which constitute a passage from the **TRIAS** to the lower **LIAS**. Such deposits, of course, indicate slow geographical changes in any particular area at the period of their formation.

PASSAMEZ'ZO, a quicker and less stately variety of the **PAVAN**.

PASSAU, a town of Bavaria, situated in a picturesque defile, at the point where the Danube is joined by the Ilz and the Inn, 105 miles E.N.E. of Munich, consisting of the town itself and three suburbs. The population in 1881 was 15,365. A handsome bridge, resting on seven piers of granite, crosses the Danube, which is 754 feet wide. The Inn is 800 feet wide, and on its right bank is the suburb called the Innstadt, connected with the town by a bridge. On the other side of the Danube, and on the left bank of the Ilz, lies the Ilzstadt. The third suburb is called the Anger. Passau commands the passage of both the Inn and the Danube. In the angle between the right bank of the Ilz and the Danube there is a rock 400 feet high, upon which stands the fortress of Oberhaus. The town of Passau itself is pretty well built; among the public buildings the most remarkable are the bishop's palace, the lyceum, the cathedral, the church of St. Michael, church of St. Paul, and the old abbey of St. Nicholas, a gymnasium, the ecclesiastical college, and the post-office, where the treaty of Passau, which conferred religious liberty on tl-

Protestants of Germany, was signed in 1552. In the Domplatz, the handsomest square in the town, stands the colossal bronze statue of King Maximilian Joseph, erected in 1828. There are tobacco, snuff, and porcelain manufactories, extensive breweries, tanneries, and paper-mills. At Oberzell, a village near, the **Passau crucibles** are made. Steamers ply on the Danube, and there is a railway to Munich and Vienna.

PASSENGER PIGEON (*Ectopistes migratorius*) is a species of PIGEON (Columbida) common in the United States, remarkable for its habit of performing extensive migrations in vast flocks. These movements are under-



The Passenger Pigeon (*Ectopistes migratorius*).

taken in search of food, especially beech-mast, of which these pigeons are very fond. They fly high in the air in such enormous numbers that the sun seems to be eclipsed, and the flapping of their wings sounds like distant thunder. When they discover abundance of food they descend, and are then destroyed in great numbers for the table. Their flight is extraordinarily rapid, for pigeons are often captured in the state of New York with their crops still filled with the undigested grains of rice which they must

have taken a few hours before in the distant fields of Georgia or South Carolina. Occasionally this pigeon occurs in England. The passenger pigeon has long pointed wings and a large wedge-shaped tail. Its colour above is bluish-gray; the sides of the neck are reddish-chestnut, with brilliant golden-green and purple tints; the wings are lead-gray, and the coverts exhibit a few black spots; the chin is bluish-gray, and the remainder of the lower surface chestnut, becoming paler on the belly, and leaving the vent and lower tail-coverts white; the two middle tail-feathers are blackish brown, and the remainder white, more or less tinged with gray and lead colour, especially towards the base. Its length is 17 inches. The female is smaller and duller in colour, the under surface being of a pale ashy colour. The nest is composed of a few dry twigs, and contains two white eggs.

PASSEPIED, the French dance which preceded the minuet, was called *passey* by our forefathers. Sometimes *passey-measure*, sometimes *measure* only. It was the favourite dance of the time of Queen Elizabeth, and was quicker than the minuet. The phrase was to "run a passepied," not to "dance" it. The dance was attributed in origin to the merry-makings of the sailor folk in Brittany.

PAS'SERES is the most important order of Birds, containing more than the total number known, and at the same time being perhaps the most typical birds. The Passeres are pre-eminently adapted for perching among trees, whence the old name *Insectoros*; and it is by their perching feet that they are chiefly distinguished from other birds. The legs are of moderate length, and the feet consist of four well-developed toes, placed three in front and one behind, provided with claws of moderate length, that of the hind toe being larger than those of the other toes. The feet, while not strongly prehensile like those of the birds of prey, are yet endowed with sufficient grasping power to maintain the bird firmly on its perch. The bill in passerine birds is very various in form, but it is never strongly hooked, nor is its base covered by a cere. The wings are generally fairly developed, but the powers of flight are more limited, as a rule, than in some other orders. The breast-bone is simple, having only one notch in the hinder margin.

Some passerine birds feed on berries and seeds, others on insects; a few, as the shrikes, on small birds, field mice, frogs, &c.; while others, as the crows, are practically omnivorous. All the birds which delight us with their powers of song are found in this order. Here, too, the nest-building instinct is seen in its most complete form; and the greatest variety prevails both in the shape of the nests and the materials out of which they are constructed.

The best method of subdividing this large order is a matter of dispute, some basing their classification on the form of the bill or the character of the wings, others on the internal anatomy. The classification according to which the *Plaves* prefixed to this volume have been arranged is based on the form of the bill. Adopting this principle, the Passeres may be divided into four sub-orders—*Tenuirostres*, *Dentirostres*, *Conirostres*, *Magnirostres*. The *Tenuirostres* (Plate I.) have the bill long, slender, and generally curved; none of them possess any powers of song. This suborder includes the sun-birds (*Nectarinidae*), honey-eaters (*Meliphagidae*), creepers (*Certhiidae*, figs. 1, 2), tree-creepers (*Dendrocolaptidae*), nuthatches (*Sittidae*, fig. 3), and the *Certhiidae*. The lyre-bird (*Menura*, fig. 4) is very aberrant, without any marked affinities with any other members of the order. The suborder *Dentirostres* (Plate II.), which contains most of our best-known songsters, has the bill slenderly conical, and the upper mandible notched or toothed, sometimes hooked at the base. In this suborder are contained the great family of warblers (*Sylviidae*), containing the nightingale, hedge-sparrow, stonechat, and other well-

known English birds; the thrushes (*Turdidae*, fig. 6), babblers (*Timeliidae*), wrens (*Troglodytidae*), tits (*Paridae*), shrikes (*Laniidae*, fig. 5), fly-catchers (*Muscicapidae*, fig. 7), and other families. The *Conirostres* (Plate III.) have a short, stoutly conical bill, the upper mandible being sometimes slightly notched at the tip. This suborder includes the finches (*Fringillidae*, figs. 9, 10), a large family containing the sparrow, crossbill, canary, linnet, and bunting as well as the birds popularly known as finches, the tanagers (*Tanagridae*, fig. 8), weaver-birds (*Ploceidae*), and the larks (*Alandidae*, fig. 11). The *Magnirostres* (Plate IV.) have a large, long, conical bill. In this suborder are placed the starlings (*Sturnidae*, fig. 14), crows (*Corvidae*, fig. 13), birds of paradise (*Paradisidae*, fig. 12), orioles (*Oriolidae*), and chattering (*Ampelidae*).

PASSIFLOREÆ is an order of dicotyledonous plants belonging to the group *POLYPTALÆ*. They are trees or shrubs, often of climbing habit, having alternate leaves, entire or lobed, with or without stipules. The flowers are usually hermaphrodite and regular; the sepals are usually five, united below into a tube, which is short in the typical forms; the petals may be entirely absent or equal in number to the lobes of the calyx, and are perigynous; a corolla, consisting of tubular or filamentous processes, arises from within the calyx tube; the stamens are from three to five, perigynous or adnate below to the ovary-stalk (*gynophore*), rarely indefinite; the ovary is superior, one-celled, with usually three styles terminating in dilated stigmas. The fruit is a berry or a capsule, and the seeds are numerous and millate. About 250 species have been described, all tropical or subtropical, and chiefly found in South America and the West Indies. The *PASSION FLOWER* (*Passiflora*) belongs to this order.

PASSING BELL (or "soul bell"), a bell tolled, according to a very ancient custom, in Roman Catholic countries at the time one of the faithful is believed to be dying. It is intended to invite the hearers to join in the prayers which are ordered "for the dying in their last agony," and which the priest is reciting in the death chamber. In some of the Protestant country villages of England a passing bell is still tolled shortly after the death of a person.

There is no doubt that originally the passing bell was held to assist the passing of souls from this life to the other, and on the rise of Protestantism great pains were taken to make it clear that, while continuing the ancient custom, the former superstition was no longer to be held as being believed—as, says worthy Bishop Hall, "we call them *soul bells*, for that they signify the departure of the soul, not for that they help the passage of the soul." In the dark ages the bells were held further to exorcise the evil spirits who lay in wait to catch the soul as it issued from the body, as many phrases of old writers abundantly testify. Moreover, an extra charge was made by the ringers for the big bell, "for that being louder, the evil spirits must go further off to be clear of its sound, by which the poor soul gets so much more the start of them; besides, being heard further off, it likewise procures the dying man a greater number of prayers" (Grose).

The celebrated "Advertisements" issued by Archbishop Parker in Elizabeth's reign for the ordering of church matters in England have this clause:—"Item, that when any Christian Bodie is in passing, that the Bell be tolled, and that the Curate be specially called for to comfort the sick person; and after the time of his passage, to ring no more but one shorte peale; and one before the Buriall, and another short peale after the Buriall."

PASSING NOTES is the name given in musical composition to notes not essential to the harmony which, under certain rigidly defined rules, are permitted to be written in positions where they are felt to be parts of a scale which is passing through the harmonies. It is essential to a passing

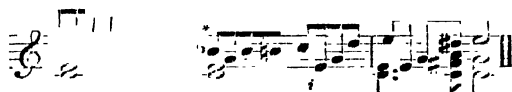
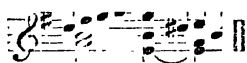
note in the strict style that it shall occur at an unaccented part of the bar, and shall have a degree of the scale on each side of it.



As the illustration shows, passing notes may be in one part (*a, b, d*), or in more than one (*c*); may resolve on to a note of the same chord (*a, b*), or on to a note of another chord (*d*); and further, that the passing note must be approached and quitted by the step of a second (never by a skip), whether it return to the original note (*a*) or proceed onward in the passage (*b*). If a passing note rise or fall in this manner, and the next note be also a passing note, that is, be not a part of the chord against which it is sounded, the passage must continue until a harmony note is reached (as at *e*), except in the one form of passage called by the Italians *nota cambiata* or "changing-note," as at *f*.



But modern usage ("free style") has greatly extended the freedom of passing notes beyond the narrow limitations above given, and the rules as now followed, except in academical writings, are these:—Passing notes, though always to be quitted by step of a second, may be approached by a skip (*g*): if it resolve downwards after a skip, a passing note must follow the scale, but if upwards it must resolve *by a semitone* to the Root, Fifth or Seventh of its chord (*h*)—a limitation not necessary in the case of the Third (*i*), to which it may proceed either by semitone or



PAS'SION FLOWER (*Passiflora*) is the typical genus of the order **PASSIFLOREÆ**. The species are numerous, being mostly herbaceous or shrubby climbing plants; a few form erect trees, and these are devoid of the tendrils with which the other species are provided. They are chiefly found wild in tropical America, but some species are natives of Asia, and many are cultivated in Britain and Europe. The leaves are either lobed or entire, and are usually provided with stipules; on the stalks of the leaves and on the leaves themselves are frequently small glands. The flower-stalk is axillary and usually provided with three bracts, which form an epicalyx. The calyx is a short tube with a spreading limb, consisting of five coloured sepals. The corolla consists of five petals alternating with the sepals; it is sometimes absent. Intermediate between the petals and the stamens are several rows of coloured thread-like processes, constituting the *corona*. This corona or crown consists of outgrowths from the receptacle, and is formed subsequently to the other parts of the flower; it is considered to have an important function in securing cross-fertilization in connection with the visits of insects. There are four or five stamens free above, but united below and adherent to a stalk which arises from the receptacle, and is known as the *gynophore*. It bears at its summit the ovary,

which is one-celled, with three parietal placentas, and terminated by three styles, each having a large button-like stigma at its extremity. The fruit is succulent, containing numerous seeds, partly embedded in pulp and provided with an aril.

The name passion flower arose from a fancied resemblance between the parts of the flower and the emblems of our Lord's passion. Thus the stigmas represent the three nails, the five anthers the wounds, the corona the crown of thorns (or according to some the "glory"). The apostles are symbolized in the ten segments of the perianth, Judas, who betrayed, and Peter, who denied, being absent.

The fruit of many of the species is eaten in their native country, the pulp in which the seeds are embedded being fragrant and refreshing; the fleshy aril is also eaten. The Granadilla, which is occasionally seen in Covent Garden, is the fruit of *Passiflora quadrangularis*, and weighs as much as 7 or 8 lbs. The water-melon of the West Indies is the fruit of *Passiflora lamiflora*, and the sweet calabash that of *Passiflora maliformis*. Other parts of the plant in some species are medicinal; thus the root of the species that furnishes the granadilla has narcotic properties, as have also the flowers of *Passiflora rubra*, while the leaves of other species are useful in intermittent fevers.

Many species are cultivated for the beauty of their flowers. *Passiflora corulea*, a native of Southern Brazil, withstands the severity of an ordinary English winter, and even produces its orange-coloured fruits in this climate. Most of the species do not fruit unless cross-fertilized.

Tacsonia is a nearly allied genus inhabiting the same regions, but differing in the length of the calyx tube; some of the species have edible fruits.

PASSION MUSIC is the name given to that class of oratorios which have for their basis the words of the gospels, recounting the agony, trial, and crucifixion of Jesus. Plays on this sacred subject, written with the benevolent impulse to bring the tragic import of the narrative home more keenly to the rude peasantry of the dark ages, were produced at least as early as St. Gregory the Nazianzene (about 375), to whom one of the first is attributed. Passion plays even still continue here and there in remote country districts.

At the same time the priests, to give additional point to the reading of the narrative of the passion in the church services of Holy Week, divided it between various singers: one priest singing the part relative to Jesus, another that of Judas, another of Pontius Pilate, &c., or as it eventually was organized in the thirteenth century, three deacons dividing the text between them, one singing the words of Jesus, another the narrative of the evangelist, and the third the exclamations of the apostles, the crowd, &c. These exclamations were set chorally in the latter part of the sixteenth century, the setting of Vittoria (1585) being usually reckoned the best. The church chants were combined with popular hymn tunes to form a musical whole by Schütz in the seventeenth century, the hymn tunes representing a sort of commentary on the text, and his design was carried further by Sebastiani in 1672, who introduced orchestral accompaniments for the first time.

Early in the eighteenth century (1704) Reinhard Keiser combined the two representative methods, the secular and the sacred, into a musical composition resembling in general form one of his operas, but skilfully varied to suit the sacred nature of his subject. The words of Keiser's *Passion* are not, however, the words of scripture, but an original poem on the subject by Menantes, in which was introduced the "Soliloquia," as it was called, that is, occasional reflections, &c. after the manner of the choros in the ancient Greek drama. This idea, so fruitful in musical capabilities, and affording a ready relief from the strain of the regular text, continued always to form part of the Ger-

man passion music. Postel's poem on the passion was set by Handel in 1704 very finely, and Broecker's poem by Keiser in 1712, and by Handel in 1716, all of them great works. The noble "Tod Jesu" of Graun was written in 1755; and the whole series then culminated in the two Passions of Bach. Of these (St. John and St. Matthew) the Matthew Passion is incomparably the finer. It stands freely at the head of all works of the kind. In it Bach has used the exact words of the gospel, like the early masters, as well as the *soliloquies* of Keiser, and a special element of his own, namely chorales or hymns interspersed here and there with a view to permitting the congregation to take part, as they usually do in divine service. This noble work, still the admiration of all, and in constant use in our churches and cathedrals at Passion-tide, appeared in 1729. It is on a colossal scale, for two choirs, two orchestras, and an organ; and is one of the greatest achievements, if not the greatest of all, in the polyphonic or contrapuntal style of dramatic writing.

PASSION WEEK, according to Roman Catholic usage and the rubrics of the Anglican Prayer-book, is the week which commences on the fifth Sunday in Lent, called Passion Sunday. In the Roman Catholic Church the whole of the last fortnight of Lent is called Passion-tide, and during that time all the services are more solemn than usual. The week immediately preceding Easter, commonly called Holy Week, is often identified with Passion Week, but this is incorrect.

PASSIONISTS, a religious order of priests in the Roman Catholic Church, founded in 1737 by Paul Francis. The founder died in 1775, and for a long time the congregation remained in obscurity; but during the last forty years it has wonderfully increased, and now has establishments in Italy, England, Ireland, Belgium, Australia, and America. The special object of the society is to preach "Jesus Christ and him crucified." The cross appears everywhere as its emblem, and forms a striking part of the costume of the preachers. They go barefooted, and their discipline is very severe. Their chief work consists in preaching sermons on the passion of Christ and holding confessions.

PASS'OVER, the first of the three great annual festivals of the Israelites, celebrated in the month Nisan, from the 14th to the 21st. According to the Pentateuch the feast was established to commemorate the deliverance of the people from Egypt, and its name is derived from the Hebrew verb *pasach*, to pass, to leap or skip over, the angel of Jehovah having *passed over* the homes of the Hebrews when he smote the first-born of the Egyptians. The account of the first passover and its consequences is given in Exodus xii., certain injunctions being given for its observance in the following chapter which have reference only to the subsequent settlement of the people in Canaan. Further important modifications of the original institution, with some additional observances, are to be found in Lev. xxiii., Num. xxviii., and Deut. xvi. In the later periods of Jewish history, that is, subsequent to the exile, the following appears to have been the general order of the observance of the Passover:—On the 14th of Nisan, all leavened bread was put out of the houses, and every male Jew was required to appear at the national sanctuary with an offering of money according to his means. As the sun was setting the lambs which had been selected were killed, roasted whole, and eaten with unleavened bread, bitter herbs, and a sweet sauce made with vinegar, figs, dates, almonds, and spice. During the feast the conversation turned upon the circumstances under which it was instituted, the younger members of the family being specially signalled out for instruction. Though there is no mention of wine in the Pentateuch, the Mishna strictly enjoins that there should never be less than four cups of it provided at the Passover meal, even of the poorest Israel-

ite. There is no mention either of any service of praise in the law, but in the actual celebration, the Hallel (a contraction of *Hallelujah*), or series of psalms, from Ps. cxlii. to cxviii., was sung. No portion of the feast might be reserved until morning, all that was uneaten being burned. The whole feast lasted seven days, during which additional sacrifices were offered and restraints from labour imposed, while only unleavened bread was eaten, and it was brought to a close by a holy convocation at Jerusalem. As the feast could only be observed at Jerusalem the Jews who lived elsewhere were accustomed, when their means permitted, to make the occasion one of pilgrimage, those who could not obtain accommodation in Jerusalem encamping without the walls in tents, much as the Mohammedan pilgrims do at the present day at Mecca. In reference to this custom Dr. Thomson observes:—"I have often tried to realize the appearance of these profound valleys and high hills around Jerusalem during the great feasts. Covered with olive-groves, fruit-orchards, and vineyards, beneath whose friendly bowers many a happy family and neighbourhood group assembled, rising rank over rank to the top of the mountains, I marvel that no artist has thought of reproducing this scene. Innumerable thousands gathered to the Passover, with happy children, busy servants, festooned victims; and all the joyful host, in picturesque costumes hastening thither and thither, as business, or pleasure, or worship prompted, furnishing all the elements for the most magnificent and impressive panorama the world has ever beheld."

After the destruction of Jerusalem the offering of the Paschal lamb was discontinued by all save the Samaritan Jews; but the unleavened bread, the bitter herbs, and other adjuncts of the feast were still retained, and at the present day the institution of the Passover, like the Feast of the Atonement, is held in importance by the entire community of the Israelites. Owing to the uncertainty prevalent at one time with respect to the fixing of the new moon, the Paschal meal is celebrated on the first *two* nights of the Passover week. At the feast as observed to-day, it is usual for the table to be furnished with a roasted lamb bone to represent the Paschal lamb formerly sacrificed, a roasted egg in commemoration of the ancient temple festival, unleavened bread, bitter herbs, a dish of salt water, and another of sweet sauce. A cup of wine, which is replenished four times, is provided for each member of the company, but the wine used is not, as a rule, a very potent beverage. A simple ritual, which includes the recital of the Passover history and appropriate prayers and psalms, is observed, and the service concludes with the recital of two curious compositions of uncertain origin, but evidently of considerable antiquity, designed to keep alive the traditions of the race. The first of these consists of a series of thirteen riddles, commencing with the question—"Who knows one?" *Answer*, "I know one. One is our God in heaven and earth." The question is repeated with the different numbers up to thirteen, and the answer to the last question recapitulates the answers of the previous twelve thus:—"There are thirteen attributes, twelve tribes, eleven stars, ten commandments, nine months preceding childbirth, eight days before circumcision, seven days of the week, six orders of the Mishna, five books of the law, four mothers in Israel, three patriarchs, two tables of the law, and one is our God in heaven and earth." The other composition, which is evidently the source from whence certain familiar nursery rhymes have been derived, contains ten verses, each of which ends with the refrain "One only kid, one only kid." It commences with the words—

"One only kid, one only kid,
Which my father bought for two zuzim,"

and the substance of the whole is embodied in the concluding section, which runs thus:—

¶ Then came the Most Holy, blessed be He !
 And slew the Angel of Death
 That slew the slaughterer,
 Who killed the ox,
 Which drank the water,
 Which quenched the fire,
 Which burnt the stick,
 Which smote the dog,
 Which bit the cat,
 Which ate the kid,
 Which my father bought
 For two zazim :
 One only kid, one only kid."

By many of the Jews this story is regarded as a parable of the past and future of the chosen people, represented by the kid. The two pieces of money represent the tables of the law, and in the fate of the kid and the subsequent events are symbolized the conquering of Judea by Babylon, of Babylon by Persia, of Persia by Greece, of Greece by Rome, of Rome by the Goths, &c.—the establishment of the kingdom of God upon earth, when Israel shall be restored under the rule of the Messiah, being the interpretation of the concluding stanza.

By the majority of Christian theologians the Passover has been regarded as a type or symbolical prophecy of the sacrifice of Christ, following the words of Paul the apostle (1 Cor. v. 7). Much ingenuity has been shown by primitive and mediæval ecclesiastical writers in pointing out the way in which all the various details of the observance find a fulfilment in the life and death of Jesus Christ. From the fact that the crucifixion of Christ took place either on the day of the Passover, or immediately after it (it is impossible now to ascertain with certainty upon which of the two days this event occurred), the festival of Easter was observed by many in the early church on the same day as the Jewish Passover. As mentioned under EASTER, this arrangement was afterwards altered, and a method for calculating Easter was adopted to keep the two celebrations distinct as far as possible. The plan was not wholly successful, as at rare intervals the Jewish and Christian festivals are observed on the same day. The last time this occurred was on 3rd April, 1825, and it will not occur again until 1903.

In conclusion, it must be observed that the origin of the feast of *Pesach* (literally "the sparing"), as the Jews call what we name the Passover, is not accepted, as given in Exodus, by the majority of those modern scholars who consider the Pentateuch as of far later date than Moses. Briefly stated, the modern theory is that in the Passover of later Jewish history we see the transformation and centralization, under royal and priestly influence, of a feast in honour of the harvest and the increase of flocks and herds which at earlier periods was generally observed throughout the land. It is supposed that the ancient form of the feast consisted chiefly in the offering of the first harvest sheaf to Jehovah, and the eating of parched corn or unleavened bread. Afterwards this feast was combined with the quite distinct *Pesach* festival, the sacrificial new-year's offering of firstlings from the flocks and herds; and when the Deuteronomic legislation was enforced in the reign of Josiah, it was enacted that it should be observed only at Jerusalem (2 Kings xxiii. 21, 22; 2 Chron. xxxv. 1-19). At a still later period, when the people had come under foreign rule and found their chief bond of unity in their religion, the gifts to the priests and special sacrifices were added to the original institution, and the feast was observed in the manner already explained. See also under PENTATEUCH.

PASSOVER CAKE. The "unleavened bread" of the Jews is now made in very large circular oat-cakes, baked pleasantly crisp, and made as thin as possible, almost a wafer. The oat-dough is not fermented, but a little soda or carbonate of ammonia is usually added to lighten it, and it swells in large bladders in the baking.

It is baked very dry for keeping, and this is facilitated by its thinness; so long as it is kept from moisture it will resist the action of the atmosphere, and in this way may be kept for an indefinite time. Passover cake is a most agreeable food, as a change, and many Christians enjoy it at Jewish Easter-tide by the courtesy of their Jewish friends. Most of it is made abroad and sent over to this country.

Ordinary oat cakes or oat-biscuits, even if only about a quarter of an inch thick, as they often are, do not get so thoroughly dried throughout as passover-cake, and if therefore kept long are apt to turn sour.

PASSPORT, a printed permission signed by the proper authority of a country, which allows a subject of that country to leave it and go abroad. When he has obtained this the bearer must have his passport signed by the minister or agent of the state to which he intends to proceed. A foreigner who wishes to leave a country where he has been residing, generally obtains his passport from the minister or agent or consul of his own state. Such a document states the name, surname, age, and profession of the bearer, describes his person, and serves as a voucher of his character and nation, and entitles him to the protection of the authorities of other countries through which he may pass, and which are at peace with his own.

Within the United Kingdom and her colonies no passports are required, though by 6 & 7 Will. IV. c. 11, s. 3, they may be demanded from foreigners on their arrival from abroad. When the war between Germany and France commenced in 1870, all persons travelling in France were again required to furnish themselves with passports, and the system was perpetuated by the new government of M. Thiers at the conclusion of the war. It led to such inconvenience, however, and was so generally complained of both in France and England, that it was abolished in 1872. Passports are not required in time of peace in Belgium, Holland, Norway, Sweden, Prussia, and Italy; but the traveller to Russia and to some other parts of the Continent must still furnish himself with a passport, which can be obtained from the secretary for foreign affairs on the recommendation of a magistrate, physician, solicitor, or clergyman, and must be *vised* by the minister or consul of each country the holder intends to visit. Even where passports are not demanded, they are always useful as a ready means of proving identity. In England they are subject to a stamp duty of sixpence.

PASTA, GIUDITTA, a famous Italian singer, was born at Como in 1798, her family name being Negri. She studied at the Conservatorio at Milan, and while yet only seventeen appeared in opera in several towns in Italy. She married Pasta, a tenor singer, in 1816, and in the year of her marriage came first to England, but at that time was not remarked as unusually good. Her great fame did not indeed reach her till 1822, when at Paris she seemed to take a sudden spring up to the summit of the vocal art. Her voice ranged from *a* to *d'*, a beautiful, full, exceptionally mobile and expressive soprano. She was also one of the finest tragic actresses who ever trod the stage; and even the great Talma exclaimed in 1826, after seeing her, "Here is a woman of whom I can still learn something." In 1824, and later, she came to London, and was rapturously received. Her great period did not last more than about ten years, and she, like so many other great artists, committed the grave mistake of singing after her voice had lost its freshness, appearing in England in 1837 and in St. Petersburg in 1840; she even sang in London in 1850, but it was very painful to her friends. Madame Pasta died at her villa on the Lake of Como in 1865.

PASTE, a term which is very loosely applied to substances differing so widely from each other that no general definition can be framed to include the whole. Whenever it is used, however, it may be taken to indicate a substance or composition which in the primary stage of its manu-

facture appears in a soft plastic or semi-gelatinous condition. The adhesive paste of common use is made by mixing wheaten flour with water in the proportion of about 2 lbs. to a gallon, and then boiling the whole to a perfectly smooth consistence. The water is added to the flour by degrees, and must be well stirred in to prevent lumpiness, and the paste must be stirred while boiling to prevent burning. Paperhangers usually prefer to mix the flour with cold water, to a very thick creamy consistency, and then to add rapidly the proper quantity of boiling water direct from the fire, stirring the paste as the boiling water is added. They do not boil the paste. In this method, however, the water must not be allowed to cease briskly boiling, or the paste does not properly thicken. The addition of a little powdered alum helps to increase the adhesiveness of the paste, and tends to preserve it from getting mouldy. Shoemakers and bookbinders add resin to the flour instead of alum, and this makes the paste very thick and tenacious. The addition of a few drops of creosote, oil of cloves, or a little powdered camphor, eucalypt, or corrosive sublimate will prevent insects from attacking it, and preserve it in covered vessels for years. The cement for pottery, wood, stone, &c., known as *Chinese paste*, is made by reducing bullocks' blood to dryness by a gentle heat, powdering it, and mixing it with quicklime in fine powder, 10 lbs. of blood requiring 1 lb. of lime. When used it is moistened with water and at once applied.

Numerous substances used as food are prepared in the form of paste, such as the anchovy, bloater, lobster, and shrimp, pastes made by pounding the fish in a mortar with salt and cayenne pepper, and rubbing the pulp through a fine hair sieve; and fruit pastes, prepared by adding to each pint of the strained juice of the fruit one ounce of gum-arabic, evaporating the whole to the consistence of a syrup, and then adding an equal weight of bruised white sugar, after which the paste may be poured out on an oiled slab, and when cold cut into lozenges for use. For the pastes of flour used in cooking see under *PASTRY*.

The pastes (*pâtes*) of French pharmacy are compound medicines of the consistence of hard dough, which do not stick to the fingers. They are prepared by mixing gum-arabic, sugar, and the requisite medicinal agent into a stiff paste which, when dried, assumes the form of jujube. They are employed internally in doses more or less variable in a similar manner to lozenges. There are also numerous other medicinal pastes prepared for external application, which act as caustics, rubefacients, or as sedatives, as well as a variety of tooth pastes, depilatory paste, shaving pastes, &c.

Polishing pastes vary according to the materials upon which they are to be employed. For cleaning brass-work rotten stone is beaten to a paste with sweet oil or with soft soap, a little water being used when it is applied; or four parts of rotten stone to one of oxalic acid in fine powder, and one and a half of sweet oil, are mixed with turpentine in sufficient quantity to make a paste. Polishing paste for iron or steel is made up of equal parts of emery in fine powder and hard, and that for pewter from two parts of bathbrick to one of soft soap with a little water. Furniture paste is made by adding scraped beeswax to oil of turpentine in the proportion of 4 oz. to a pint, putting the vessel into hot water and stirring it until the mixture is complete. If a red colour is wanted, a little alkanet root may be digested in the oil of turpentine before the beeswax is added.

Paste is also the name given to sundry vitreous compounds made in imitation of gems and precious stones. Like enamels, the artificial gems have for their basis a very fusible, highly transparent, and brilliant dense glass, termed "paste" or "strass," which is generally formed of oxide of lead, potassa, and silica, with small quantities of other ingredients to impart brilliancy and clearness,

the characteristic tints being imparted by the addition of metallic oxides.

PASTER is that part of the horse's foot which extends from the fetlock to the heel. The word comes from the old French *pasturon*, and means that part by which the horse is tethered while at *pasture*. The pastern of a horse consists of the first and middle joints of his finger or toe (using terms of our own hand and foot), the coffin-bone being the end joint, and the hoof the nail. The word pastern is more accurately limited to the joint between the two pastern-bones, and these latter are called the great pastern (next the fetlock) and the small pastern (nearest the hoof).

PASTILE or **PASTILLE**, another word for paste. It is sometimes applied to those varieties of lozenge which are made of confectionery paste. In a more restricted sense, however, it refers to fumigating pastiles, which are burnt as incense or to diffuse an agreeable odour. These pastiles are composed of charcoal, aromatic gums, scented wood or bark, and essential oil. They are made into a paste, cut into small cones, and when dry are used by lighting at the point, and as they burn the aroma is given out with the smoke. Usually they are burnt in a little china or metal vessel, with a perforated top.

PASTON LETTERS. This celebrated collection of 1006 letters is one of the most valuable of English historical treasures, as it illustrates, in a manner unattainable by any history or formally prepared account, the real inner *how*-life of our forefathers. It extends from 1421 to 1509, that is, through the reign of Henry VI., the Wars of the Roses, and the whole dominion of the house of York, and onwards to the accession of Henry VIII. Most of the letters are addressed to John Paston, Esq., of Norfolk, who died in 1466, to Sir John Paston his son, who died in 1479, and to John Paston, of Gelston, who died in 1503.

The first two volumes of the letters appeared in 1787, edited by Mr. John Fenn, who received the honour of knighthood for his great services in this important work. On receiving his new dignity Sir John presented George III. with the original letters, bound in three volumes. They were originally the property of William Paston, earl of Yarmouth, who sold them to the antiquary Le Neve. His widow married Mr. Martin, of Pulgrave, Suffolk, and from him they passed to Sir John Fenn. Two extra volumes were afterwards added by Sir John Fenn, and the whole of the remainder was put into a fifth volume by Sergeant Frere in 1823. Notwithstanding this unimpeachable descent, the letters have been often challenged, especially by the Society of Antiquaries, in a formal discussion in 1865; the full report of the committee being published in 1866. The case against the letters rested upon supposed internal evidence, but would not have "held water" a moment if the letters themselves were forthcoming. Unfortunately the MSS. presented to George III. have been stolen, and the thief has never been discovered. As to the remainder the MS. of the Frere volume (fifth) of 1823 was discovered during the height of the great controversy at Sergeant Frere's private house. And ten years later (1875), to the great relief of antiquaries and historians, the complete letters of the third and fourth volumes of Sir John Fenn were found at the family mansion of the Freres at Roydon, near Diss. After this, and the thorough investigation by competent antiquaries of the original letters, there can be no possible doubt of the genuineness of the collection. The best edition of the whole collection is that of Gairdner, with 400 additional letters gained from other sources, three volumes, with introductions and commentaries (Arber's reprint, London, 1872-75).

PAS'TORAL (from the Latin *pastor*, a shepherd or herdsman) is the name given to poems descriptive of the pursuits of country life, or to dramas in which the characters represent shepherds or other country-people.

The oldest pastoral poetry is that among the Hindus and

the Hebrews, many strictly pastoral pieces being included in the ancient scriptures of these peoples (e.g. the story of Ruth in the Bible). But in secular poetry certainly the idylls of Theokritos, the famous poet of Sicily, who sang his simple songs after all the great era of Greek literature had long ceased, must be regarded as the progenitors of this branch of literature. Theokritos wrote his sixteenth idyll in the year 270 B.C., but this is one of the very few dates that is certain about him. The dramatic element in his poetry is charming, and this was carried farther, perhaps too far, by his imitators, Bion and Moschos, under whom what was or seemed natural in Theokritos betrayed its artificiality. All these poets took the Doric dialect of classical Greek as their medium—a form of speech whose relation to Attic is often symbolized by the relation of Scottish (not Gaelic) to English. It should be mentioned that the word *idyll* (Gr. *eidullion*), though used for his pastorals by Theokritos, was not limited to pastoral subjects. It is the diminutive of *eidos*, form, feature; and the meaning of its use was that the poet intended, as another and a greater poet did long centuries after, "to hold as 'twere the mirror up to nature, to show virtue her own feature, scorn her own image, and the very age and body of the time his form and pressure" ("Hamlet," in 2). This is why Theokritos in his delightful sketches of Sicilian country life chose the most countrified of the dialects of Greece, rendering the humour, which is frequent with him, more quaint, and, at the same time, preventing the more poetical parts from seeming artificial. Not so careful, as before observed, were Bion and Moschos.

But the great Latin poets of the Augustan age when they seized upon the pastoral as a mere form of literature went entirely on the lines of Moschos, not of Theokritos. Their Latinity was no countrified dialect, their poetical thoughts were expressed in not studiously simple phrases; no flash of fun or trait of character was found; on the contrary the "Bucolics" of Virgil (as they were called, from the Greek *boukolikos*, agricultural, pastoral) are among the most purely and coldly artificial poems we have. The difference between Virgil and Theokritos is akin to that between a head-boy of Marlborough and a shepherd of Watteau; tatters and hearty natural good humour are replaced by fluttering ribbons and sniggering grace. We admire the perfect skill, but we deplore the vanished "touch of nature."

It was a matter of course that when the Renaissance brought about a revival of culture on the lines of classical forms the great Latin master should be held as the model, and the purer type of the great Sicilian left unrecognized. Besides, it is inherent in all imitative art (as this of the Renaissance), that it shall worship form rather than essence; and the form of Virgil was perfect. Therefore the pastorals of Boccaccio, like those of Virgil, tell us nothing at all, accurately speaking, about the humour of the country people of this time. Nevertheless when Boccaccio's "Admetus" appeared in the middle of the fourteenth century, artificial and full of "conceits" as it was, it raised up a host of imitators and created a school whose pernicious influence lasted many centuries. The note given by Boccaccio was taken up by Politian (Agnolo di Monte Pulciano, called Poliziano), the protégé of the Medici, whose *favola* or pastoral tale of "Orfeo" (1472) in *terza rima*, Dante's verse, is the first approach to the pastoral drama of the middle ages, since it narrates, though in the artificial pastoral style, a complete story. Niccolò da Correggio's "Cefalo" (1486) similarly, though in the easier *ottava rima*, told the story of Kephelos and Prokris as Politian had done that of Orpheus; and, like it, bore the name of *favola*. The "Arcadia" of Jacopo Sanazzaro (1458-1532), which was published in 1504, is another famous poem of far-reaching influence. It is partly in verse, the prose portions serving to connect together and introduce the eclogues in verse. The "favola pastorale," or *boccaccistica*, rose to

its greatest popularity when Boccaccio fixed its final form as dramatic. He produced his pastoral comedy "Il Sacrificio" at Ferrara in 1554, and Tasso followed with "Aminta" at the same splendid court in 1573. The finest work in pastoral drama, however, is undoubtedly the famous "Pastor Fido" of Guarini, brought out at Venice in 1590. These are only some of the chief Italian works, out of countless numbers of pastorals which at this time deluged that country, in the lyrical as well as the dramatic style. Spain and Portugal developed a large literature of this class at this same time, Elcina writing at the beginning of the century (1500), and Garcilasso de la Vega (1526) shortly afterwards; indeed, practically all the poetical work of these years took this form in Spain, owing to the vast influence of Italy upon the court of the Emperor Charles V. The great Cervantes himself wrote a pastoral, "Galatea," in 1581.

In England, about 1500, we received our first English pastoral at the hands of Robert Henryson, a schoolmaster of Dunfermline. His "Robene and Makyn" has much natural and simple beauty. The next poem of note fairly to be called a pastoral is the "Shepherd's Calendar" of the immortal Spenser (1579). This is a most remarkable work. Spenser, like a true poet, chooses a somewhat antique English for the talk of his shepherds, and though these are certainly types and not men, yet the artificiality is never excessive, and humour and character abound. The figurative habit of mind in Spenser led him to choose this mode of attacking the church abuses of his day, and his unfaithful shepherds are such as "Morell" (i.e. Aylmer), bishop of London, while the faithful pastors are such as "Algrind" (Grindal, archbishop of Canterbury)—names veiled under the thinnest disguise; the sheep are of course the flock of the church. Spenser was not the first great poet to strike at high politics under this simple guise. Clement Marot, in 1531, had written his "Complaint (i.e. Lament) of Louise of Savoy," the mother of Francis I., and under the figure of good and bad shepherds sang not obscurely of the new Huguenot aspirations. In fact Spenser's eleventh eclogue was almost a translation of Marot. But all Spenser's eclogues are not political in the "Shepherd's Calendar;" for instance, we have the charming love-idyll of Rosalind the Cruel, which inspires the first and the sixth of them, and tales in Chaucer's style fill others. Spenser's "Shepherd's Calendar" appeared in 1579. The next year saw the beginning, on the part of his noble friend Sir Philip Sidney (to whom the "Calendar" had been dedicated), of that noble unfinished "Arcadia," which has finally set the stamp upon prose pastoral romances in England. This famous work, unhappily more talked about than read, is as much a poem as if it were all in verse instead of only containing verses here and there. A fine heroic element, as was natural in so noble a gentleman, pervades the whole romance. It is easy to trace the large influence of the pastoral school upon Shakespeare: the sweet pastoral comedy in the "Winter's Tale," the ever fresh sylvan scenes of "As you like it" occur instantly to the mind; and yet transmuted to a higher value, like everything else in his hands, the dull gilt of the artificial Italian pastorals has become pure gold in Perdita and Rosalind. The immeasurable superiority of Shakespeare is nowhere better seen than in contrasting his use of the pastoral style with that of Beaumont and Fletcher in their play of "The Faithful Shepherdess" (1610), excellent and really poetical as it is. A fine collection of pastoral works now arose. The chief are Breton's "Passionate Shepherd" (1604); Wither's "Shepherd's Hunting" (1615); Browne's delightful Devonshire idylls, "Britannia's Pastorals" (1616); and some fine pastoral masques of Ben Jonson. In the next generation the country lyrics of Carew, Lovelace, and Suckling revived pastoral in a slightly different form, and Herrick raised this to the first rank with his unrivalled lyrics, pastoral in his

hands, becoming a real thing for the first time, genuinely studied from outdoor country life, and no longer the product of the desk alone. A number of pastoral dramas, of little value, as Fanshawe's "Pastor Fido" (1646), and Settle's (1677), followed Herrick.

When in the age of Anne a classical revival came, and we had the so-called Augustan era of English literature, the "Bucolics" of Virgil of course found imitators, like all the other Augustan forms of literature. The "Poetical Miscellanies" of Tonson contained in their sixth part (1709) pastorals by Ambrose Philips and by the young Alexander Pope, Philips studying Spenser as a model in many things, Pope purely founding his style on Virgil. Better far than the "Cuddy" and "Hobbinol" of Philips, or the "Daphnis" and "Strophon" of the boyish Pope, were the six pastorals of Gay called the "Shepherd's Week" (1714), which abound in humour and are redolent of genuine country life and character. And still far beyond Gay stands Allan Ramsay, who in his "Gentle Shepherd" (1725) attained the highest mark, save Spenser, of English pastoral. This and Gay and Herrick and Spenser (with Sidney's "Arcadia") represent all that really lives out of the mass of pastoral literature. With the coming of the revolutionary era, whose poetical children were Byron, Coleridge, Wordsworth, and the like, all this stage glamour was swept away. Our peasants now are the "Northern Farmer" of Tennyson, or those quaint rustics who figure in the novels of George Eliot and Thomas Hardy and the like, figures painted from the life and full of a perennial human interest considerably beyond that of the flutter of ribbons, the tinsel of gilded crooks, the murmur of mock rhyme-combats, and the studied Watteau-like groups which served as an elegant representation of shepherd life for our forefathers.

PASTORAL LETTERS are circulars addressed by a bishop to his diocesans for purposes of religious instruction or admonition in matters of discipline. This name also is derived from "pastor," the bishop being considered the shepherd of his spiritual flock.

PASTORAL STAFF, a distinguishing staff of authority borne before a bishop, the top of which is curved into the form of a shepherd's crook, and is therefore sharply to be distinguished from the CROCIER of an archbishop, which ends at the top in a cross. In Roman Catholic times an abbot's staff resembled a bishop's, but was borne with the crook pointing towards the abbot, his authority being purely within his monastery. The bishop's staff was carried with the crook pointing forwards, for the converse reason.

PASTRY consists of articles of food of which a paste of flour and butter forms a principal and characteristic ingredient. The finest kind made is usually termed "puff paste," and it is prepared by making a soft dough of fine wheaten flour and good butter, free from water or buttermilk, in the proportion of 4 oz. of butter to 1 lb. of flour, with cold spring water, spreading the dough out thin, and putting a layer of butter over it amounting to double the previous quantity, and then folding and rolling the dough several times, so that in all a pound of butter is used to each pound of flour; the water would amount to not quite half a pint to each pound of flour. To make puff paste successfully the flour must be perfectly dry, must be worked into dough with a light hand, and after the second or third folding the dough should be exposed for a time to a low temperature before proceeding further with the process; and lastly, baking the paste in a moderately smart, but not too hot an oven. Soyer recommends that the paste should be worked upon a marble slab, that it should be rolled seven times, and twice placed upon ice to cool during the process. The paste, being placed in the oven, consists of alternate laminae of butter or fat and ordinary flour dough; and during the process of baking, the elastic vapour, disengaged, being in part restrained from flying off by the buttered surfaces of the dough, diffuses itself between

these laminae, and causes the mass to swell up, and to form an assemblage of thin flakes, each of which is more or less separated from the other. The thinner and lighter the flakes are, the better is the puff paste.

Short paste is made with dry and warm flour, sugar, butter, and water, made into a paste of firmer consistency than puff paste. This paste takes only three-quarters of a pound of butter and one-third of a pint of water to each pound of flour. The sugar spoken of is merely a table-spoonful. This when baked has none of the flaky character of puff paste, but it is better adapted for raised pies, &c.

The indigestibility of pastry, and, oddly enough, especially of light pastry, is so universally known, and to the epicure so painful a subject, as to demand explanation. The most generally favoured explanation now given by physiologists is twofold. First, the mechanical reason is that in light flaky crust the pastry crumbles readily to pieces under the teeth ("melts in the mouth"), and consequently comparatively large flakes get swallowed without mastication. Secondly, the chemical reason is that by the composition of the crust much of the starchy matter is enveloped in fat, and the saliva cannot penetrate the fat, its action being limited to the starch. The first stage in the digestion of starch, its partial conversion into sugar, is thus missed, and the ground lost cannot be regained. It follows that the heavier plainer crusts, demanding more mastication, get properly ground fine, and the fatty coverings are mechanically broken down, so that the starchy constituents are attacked, as they should be, by the saliva; and thus the paradox is explained. The richer (fatter) a crust is the more indigestible it becomes; and therefore, as a general rule, the lighter the pastry the greater care and thoroughness is required in its mastication.

PASTURE LAND (Lat. *pastura*, a feeding ground). The pasturage of cattle has long been a part of regular husbandry. The land which affords the herbage for cattle forms part of a landlord's private possessions, and a rent is paid for its use. Pastures are now fenced and protected, and pains are taken to improve them, so as to maintain many more cattle or sheep than they would in their natural state. We shall not here speak of rich grass lands, in which bullocks and sheep are fattened, and which are commonly called grazing land; nor of artificial pastures, which form portions of arable farms, and have been depastured only to enrich them and make them more fit to produce corn when again submitted to the plough; but we shall consider those tracts of land which, from situation, climate, or other causes, although they are portions of certain estates and the property of individuals, lie nearly in a state of nature, and produce a revenue or profit only according to the number of cattle and sheep which can be reared or maintained in them. Such are the rich pastures on the Jura, the Alps, and the Pyrenees, too high and exposed to allow of cultivation or permanent habitation, but producing abundant food for cattle in particular seasons of the year.

Whenever pastures are hired, the rent is generally reckoned, not by the extent of surface, but by the stock which can be maintained upon it. Thus in Switzerland the mountain pastures are divided into portions of twenty, forty, or more cows. In many places pasturing has been found much more productive than cultivation; and some large proprietors have converted great tracts of land from arable into pasture farm. But this can only be done where the population is very scanty, and where the soil and climate do not tempt men of capital to settle.

Wherever there are large pastures in exposed situations, proper and suitable buildings made of substantial materials should be erected. The cattle should have numerous sheds for refuge in bad weather, and sheep especially should have protection and shelter. Warmth is in some cases of more importance than food; and an animal exposed to all the severities of a northern climate requires more food to

keep it alive than when kept warm and protected from the immediate influence of cutting winds.

There is another kind of pasture in England, on the chalky hills which are called Downs, where useful and hardy sheep are reared. Here the exposure is less, and the proximity to the plains give frequent opportunity of driving the sheep to sheltered situations. The grass on the chalk hills is in general very fine and short, and the quality is very good.

Pastures are seldom improved with manure, which is generally reserved for arable land, or grass land intended to be mown for hay; but if richness is valuable in a pasture, it will well repay the expense of manuring, especially with liquid manure, the drainings of dunghills and the urine of cows and horses, which is collected in a tank when they are kept in stalls. Peat ashes are also very useful, and have a powerful effect in stimulating the vegetation of all the grasses. The adaptation of the stock to the nature of the pasture is an object of the greatest importance, and requires much judgment and experience.

According to the agricultural returns of 1885, the total acreage under permanent pasture in the United Kingdom was as follows:—England, 12,229,815 acres out of a total cultivable area of 32,597,398; Wales, 1,892,663 acres out of 4,712,281; Scotland, 1,220,000 acres out of 19,466,978; and Ireland, 10,215,927 acres out of 20,819,917.

PATAGONIA, a country in South America, comprehending the most southern portion of that continent. It extends from 38° 50' to 53° 35' S. lat.; and is bounded on the east by the Atlantic, on the west by the Pacific, on the north by the Rio Negro and the Chilean province of Chiloé, and on the south by the Straits of Magellan. The length is 1100 miles, and the area is roughly estimated at 324,000 square miles.

For a long period the possession of Patagonia was a subject of contention between Chili and the Argentine Republic, but in 1881 the question was settled by a treaty which made the boundary between the possessions of the two countries the watershed of the Andes down to 52° S. lat.; the line then continues along the parallel to 70° W. lon., thence to Point Dungeness, and along the meridian of 68° 31' W. lon. This gives about 63,000 square miles to Chili.

The country comprehends two districts, which differ from one another in nearly every respect—the mountain region and the plains. The first occupies the countries extending along the shores of the Pacific and the western portion of the Straits of Magellan. The plains occupy the opposite part of the country, stretching out along the Atlantic and the eastern part of the Straits of Magellan.

The mountain chain—which comprises numerous volcanoes—belongs to the Andes, and the summits vary from 3000 to 8000 feet in height. In many places they are close to the coast, which is deeply indented; and along it whale and seal fishing is carried on. A series of high and rocky islands lie like a barrier in front of the shore, so that no part of the continent, except the peninsula of Tres Montes, is exposed to the ocean's swell. Some of these islands are of great extent; others are only separated from one another by narrow straits. Among them are Chiloé, the Chonos Archipelago, Wellington Island, Archipelago of Madre de Dios, Hanover Island, Queen Adelaide's Archipelago, and Desolation Island. In the mountain region of Patagonia the air is damp and chilly, and it is subject to excessive rains. There are large forests of timber trees; but neither the animal nor vegetable products of the country are abundant; and it is only along the Rio Negro, on the northern border, that wheat, maize, and pulse are cultivated.

Besides the Rio Negro, the Chupat (43° S.), the Desire (near 48° S.), and the Santa Cruz (50° S.), are the chief rivers of Patagonia flowing to the Atlantic; these flow in

deep-cut beds, and are liable to sudden swellings from the melting of the snows of the Andes. The last-named rises in several large lakes at the base of the mountains.

The plains of Patagonia, which form the eastern division, and occupy the greater portion of the country, extend along the Atlantic Ocean for more than 700 miles in wide tracts, which rise one above the other like terraces. They are composed of tertiary sandstone, with marine shells, clay, earth, and gravel, and are generally arid and sterile, although there are some tracts of great fertility near the rivers. The soil is strongly impregnated with saltpetre, and salt lakes of every size abound. The climate is drier and warmer than that of the mountain region, though it is very cold in the southern part in both.

The animals found in Patagonia include guanaco, pumas, foxes, and great numbers of mice. Among the birds of this region are the condor, hawk, American ostrich, ibis, &c. The coasts abound with fish.

The country for the most part is thinly peopled by Indians only, who do not anywhere cultivate the soil, but live by hunting wild cattle, ostriches, &c. Mushrooms are a common article of food. The natives are the tallest people known—the average height being 5 feet 10 inches, which led the early voyagers to describe them as a race of giants. They lead a wandering life, chiefly on horseback, and often make incursions into the southern states of La Plata. On the west coast, among the mountains, live a distinct tribe, called Fuegians by the Europeans, who are short of stature, and subsist by fishing. [See TIERRA DEL FUEGO.] The chief export from the country is guano.

The region of Patagonia was discovered by Magalhães in 1519, but no accurate survey of the coast was made till between 1826 and 1830, when it was visited by our countryman, Captain King. It was afterwards surveyed by Captain Beechey; but the interior was comparatively unknown until Captain Musters gave the first really complete and authentic account of the people and country in his exceedingly interesting work, "At Home with the Patagonians" (London, 1871). The population is estimated by Captain Musters to be only about 3000.

PATCHOULI, a well-known perfume obtained from the dried branches of *Pogostemon Patchouli*, the *Paclapât* of the Hindus, a shrubby plant of the natural order Labiate; first imported into this country from Sillhet and Malacca, Ceylon, Java, and Bombay, about 1844. It is employed in the East as a preservative against moths, as an ingredient in fancy tobaccos, and a perfume for the hair. Its peculiar and indescribable odour is as offensive to some persons as it is agreeable to others. The essence is an oil of a brown colour and extreme consistence, which requires to be largely diluted before it can be employed in perfumery.

PATEL'LA (Lat., a little plate, diminutive of *patella*), in anatomy, the small, flat, heart-shaped bone developed in the single tendon of the greater extensor muscles of the leg; that is, at the fore part of the knee-joint, whence it is commonly called the knee pan, or *knee-cap*.

PAT'EN (Lat. *patina*), in ecclesiastical usage, the dish or plate on which the bread is placed in the communion service of the Anglican Church. In Catholic rites, it is applied to the stand or saucer on which the chalice rests. It is usually enriched with exquisite carving, and often with precious stones. The word *paten* or *patine* is poetically employed in a wider sense, in Shakspeare's "Merchant of Venice":—

"Look how the floor of heaven
Is thick inlaid with patines of bright gold."
—Act v. scene 1.

For the *patina* of ancient home-life see *PATERA*.

PATENT. This term is applied to certain grants by the crown of limited monopolies by way of reward to those who have introduced some new and useful invention into the realm. The law relating to patents is founded on the

21 James I. c. 3, which declared grants of monopolies to be contrary to law, and enacted that all monopolies for the sole buying, selling, working, or using of anything should be void and of none effect except letters patent and grants of privilege for the term of fourteen years or under, for the sole working or making of any manner of new manufactures within this realm, to the true and first inventor or inventors of such manufactures, which others at the time of making such letters patent and inventions shall not use; so that they be not contrary to law or mischievous to trade, by raising the price of commodities at home, or hurt of trade, or generally inconvenient.

Letters patent for an invention are now granted in Great Britain in accordance with the Patents, Designs, and Trade Marks Act of 1883 (46 & 47 Vict. c. 57), as amended by the Act passed in 1885 (48 & 49 Vict. c. 63). By these Acts any person, whether a British subject or not, may apply for a patent, and two or more persons may make a joint application, and a patent may be granted to them jointly. Every patent when granted takes effect throughout the United Kingdom, and it conveys to the first inventor, discoverer, or introducer of an invention into the kingdom, the exclusive privilege of making, using, exercising, and vending such invention throughout the United Kingdom for the term of fourteen years, unless it shall have been previously protected abroad, in which case the British patent becomes void on the expiration of any such prior foreign privilege. Moreover, a valid British patent cannot be obtained after the expiration of a patent previously granted elsewhere for the same invention.

An invention must be new in order to form the subject of a valid patent—that is to say, the knowledge and right of using it must not have become public property, and it must differ specifically, and not merely in accidental circumstances, from existing and known manufactures. Further, it must be useful as well as novel, that is, in granting the patent it is implied that the public derives or may derive some benefit by the use of the patented idea. Subject to these conditions an invention may be either (1) A new device, appliance, or apparatus, or a set of all or any of these serving to produce a known result; (2) A new method or process, or a novel manner of producing by known means a known result; (3) A novel article of manufacture obtained either by known or by novel means and methods; or (4) A combination of several of the foregoing. A patent cannot be had for applying an old contrivance to a new object, as, scissors to cut seaweed; but where the application involves a new discovery of a property in the thing applied, or a new result is attained, a patent may be good. Another condition is that the inventor shall not have worked his invention for profit, nor publicly exhibited it, or described it in any publication before the date of his application for letters patent, nor must this have been done by any one else. The use of a process in the ordinary course of trade by any other person, though such use is kept a secret from all but his partners and confidential servants, will vitiate a patent for such process. The originality of an invention is not destroyed by proof that in the history of the arts and trades of this country some persons may appear to have had some glimpse of the same conception, which was not prosecuted or made known, and from which, so far as the rest of the world were concerned, no result or change followed; but the public use of an invention in any part of the United Kingdom, prior to application for a patent, will be fatal. Bare or abstract ideas cannot be patented however valuable in themselves. The principle of the invention must be embodied in a practical form; and the patent is taken out, not for the principle, but for the mode of carrying it into effect. But where the principle is a new one, the discoverer who patents one mode of utilizing that principle can claim not merely the mode in question, but all other modes of

carrying it out usefully; and if a second person finds a new mode of doing so he will not be allowed to employ it without a license from the first.

On applying for letters patent, two courses are open, viz., either to obtain provisional protection by leaving a provisional specification with the application, or to protect the invention by deposit of a complete specification at the time of lodging the application. The former course is the one most usually pursued in practice as (irrespective of other advantages generally incident to its adoption) it gives the inventor a chance of perfecting his invention, and of, to some extent, testing its merits and commercial value ere incurring further expense. The title of a patent, and the provisional specification required to be left with the petition at the time of applying for provisional protection, have such important bearing upon the validity of letters patent as to necessitate great care and experience in their efficient preparation. The former should cover the entire ground of the invention as described in the specification without disclosing any of its details, while the latter should be so drawn as to convey for the information of the law officer such a full and clear idea of the whole nature of the invention as will enable him to judge of its character, care being taken at the same time to avoid entering unnecessarily into such details as may be subsequently found capable of advantageous modification, without departure from the nature and novelty of the invention. It is absolutely necessary that the specification should be so worded as to cover all the essential parts of the invention, and it must indicate at least one method of carrying it out.

Forms of application for provisional protection are issued at the Inland Revenue Office, Royal Courts of Justice, London, and they may be obtained through any district post office. The first form consists of a petition for the patent required, coupled with a declaration that the petitioner is the first and true inventor. It must bear a one-pound stamp, and the declaration must be made before a magistrate, a justice of the peace, or a commissioner to administer oaths, or if the petitioner is in a foreign country before an English consular officer. The second form consists of the provisional specification already described, which must be made out in duplicate, and be signed by the applicant. It is necessary that the specifications and all other documents should be written or printed in clear legible characters on strong, wide ruled, foolscap paper, on one side only, leaving a margin of 2 inches on the left hand side, and that the drawings should be carefully made in black and white, and delivered either in a flat state or rolled upon a roller so as to be free from creases or breaks. The documents must be left at, or sent by post to, the Great Seal Patent Office, Chancery Lane, London. If they are informal or otherwise wrong the patent office will call upon the petitioner to amend them, and if they are in order it will notify the applicant of their acceptance. Where the application is refused the petitioner may claim a personal hearing by the comptroller, and if dissatisfied with his decision may appeal to the law officer. If at the time the application is before the office, another similar invention is brought in, or is embodied in an earlier specification, the office will notify both applicants, but without informing either in what the other's invention consists. When the provisional specification has been passed by the law officer of the crown, protection is granted for nine months, but the patent office takes no responsibility upon itself in respect to the claim. The invention may prove old, had, or useless, and the specification may prove insufficient to protect the inventor without his having any redress against the office. The nine months' protection dates from the day of application, but it may not be officially granted for a week or two after. A patentee should keep his secret at least till then, but afterwards he may publish it at his discretion, and he may use his invention publicly without

losing his right of ultimately obtaining letters patent; but until he does obtain the letters patent any one else can manufacture and sell the invention without being in any way liable to the inventor. It is popularly supposed that a patent for nine months can be obtained for £1, but this is an error.

When the provisional specification has been accepted, the applicant may either file his complete specification at once, or he may delay sending it in for a period of nine calendar months from the date of application. The forms for complete specifications are issued from the Inland Revenue Office, and they must be prepared in duplicate, one copy bearing a £3 impressed stamp. The complete specification must fully set forth what the invention consists in, and in what manner it may be carried into practice, so that others when the patent has expired may work the invention if they desire to do so. It must be accompanied by drawings where these are required to render the invention fully intelligible, and should the inventor keep back anything and fail to act in good faith he runs the risk of having his patent declared void. When the complete specification has been filed, it is examined by the patent office, and if in due order is accepted, and the acceptance is advertised in the *Patent Office Journal*. The specification also lies at the patent office open to inspection, and any one who has any objection to the grant of letters patent for the invention, or to the applicant, may oppose the issue of the patent. Oppositions must be lodged within two months from the advertisement in the *Patent Office Journal* of the acceptance of a complete specification, and if no opposition arises, or if the opposition is unsuccessful, the patent issues.

In the letters patent the inventor does not receive a title of validity guaranteed by the government, and the holding of a patent does not prove either the novelty, the utility, or the practicability of the invention. As soon as the patent is granted the invention is supposed to be known to the public at large, and the determining as to whether a patent is valuable or good is left to the patentee, or to the courts of justice. The privilege of a patentee extends for the first four years unconditionally, but during the next four years a yearly tax of £10 must be paid. The amount payable for the next two years is £15 a year, and for the last four years the sum payable is raised to £20. A patentee may (after advertising such his intention) make application by petition to the judicial committee of the Privy Council praying for an extension of the term of his patent, but the petition must be presented at least six months before its expiration. If the judicial committee report that the patentee has been inadequately remunerated by his patent it may be extended for a further term not exceeding seven, or in exceptional cases fourteen years, or a new patent may be granted under certain restrictions. An extension, however, is not granted unless the invention has proved to be one of great merit and public utility, and the patentee has not received adequate remuneration in return. It must also be proved that no detriment will arise to the public. An action at law for damages is the proper remedy against a person for infringing another's patent, and in any such action the court or judge may, on the application of the plaintiff or defendant respectively, make such order for an injunction, inspection, or account, and give such directions respecting the same as to such court or judge may seem fit. Formerly the absolute right to "make, use, exercise, and vend" his invention (with the exception of inventions relating to warfare, to which certain reservations are made in favour of the crown) was vested in the patentee to the entire exclusion of all others; but the Patent Act of 1883 contains a proviso according to which the Board of Trade may, under certain conditions, compel the patentee to grant licenses for the use of his invention upon a fair consideration.

Before the passing of the Act of 1883 it was acknowledged on all hands that the expense of a patent in England was a heavy tax upon invention, and it placed Englishmen at a great disadvantage when called upon to compete with foreigners, especially Americans. In the United States every encouragement had been given by the government to inventors, and in consequence England was being inundated with pencils, pens, gardening and other tools, knives, sewing machines, watches, clocks, &c., all of them having some novel and generally also useful feature in which they differed from the same class of goods produced in the United Kingdom. It will take some time to recover the ground thus lost by England, but the reduction of fees and the simplification of procedure introduced by the new Act have already produced some remarkable results. The provisions of the Act came into force 1st January, 1884, and during that year there were 17,110 applications for protection, not far from three times the number in any previous year, and in 1885 the number was 16,101. The decrease of 1000 is accounted for by the fact that there was an accumulation of patents waiting for the operation of the new law in 1884. As might be expected many of the applications which obtain protection prove on further investigation to be for inventions destitute of novelty or value and about 40 per cent. of them are allowed to become void at the end of the nine months. Up to the present only a small percentage of patents have lived out their full or legal term of existence, and it seems probable that a similar rule will be observed in future.

In connection with the taking out of a patent, it may be observed that much of the business is transacted through a class of practitioners termed Patent Agents, who in return for certain fees place their special knowledge at the service of their customers. There is also an Institute of Patent Agents, established in 1882, which exercises a supervision over all its members, and enforces certain rules for the conduct of the business. In the majority of cases an inventor will find it an advantage to obtain the assistance of an agent of good repute and standing, though there is nothing to prevent his acting for himself if he elects to do so.

Patents or equivalent privileges are granted in the principal colonies and in most foreign countries. The several laws and regulations vary considerably, and many of them are very arbitrary. In some countries the government payment is wholly or partially in the form of an annual tax or taxes, while in others the whole of the government fees are paid before the issue of the patent. In some states there are previous examinations as to novelty, utility, &c., and in most cases there are conditions requiring the invention to be in operation in the country where it is patented within a certain limited period. It may be questioned whether a provision of this kind ought not to be embodied in the English patent law, for it has been observed that about 20 per cent. of the applications for patents in England are from persons not resident in the United Kingdom, and the suspicion cannot but arise that some of these applications are made with the idea of preventing the working of an invention in this country, and therefore enabling its owners to supply English markets with goods manufactured abroad. In the case of English patentees, as already remarked, the Board of Trade have power under certain conditions to compel the granting of licenses, but the *maudamus* by which this provision is to be enforced cannot reach the foreigner, and the Board has no power to cancel the patent. In 1879 the German Patent Law was simplified, and one patent is now sufficient for the whole empire instead of twenty-five, which were formerly necessary. In 1883 an important convention in reference to patents, industrial designs or models, trade marks and trade names, was entered into by the governments of Great Britain, France, Italy, Holland, Belgium,

Switzerland, Spain, Portugal, Servia, Brazil, Guatemala, and Salvador, by which the subjects of each of the contracting states were in all the other states of the union placed upon an equality with their own subjects and citizens. Provision was made to admit other states to the union, an international office of the Union for the Protection of Industrial Property was established in Switzerland, and arrangements were made for a periodical revision of the convention by means of conferences to be held successively in one of the contracting states.

In conclusion it may be observed that it is much to be regretted that the fundamental principles upon which letters patent are granted are so little understood; for were it otherwise, much of what is said and written upon the subject of their abolition would at once fall to the ground. They are, as before stated, simply grants, under the great seal, of limited monopolies, by way of reward to those who have introduced some new and useful invention into the realm; and the very foundation of the grant is such as to show at once that, unless these conditions of novelty and utility are fulfilled, the grant is fundamentally invalid. Such grants are intended to operate for the ultimate good of the community at large, by placing the inventions to which they refer at the free disposal of the public when the limited term of monopoly expires; hence the condition contained in all grants of letters patent that a specification, describing in full the nature of the invention and the manner of carrying it into effect, should be duly filed. Some opponents to patents take it for granted that inventions are mostly the result of sudden ideas, which, like flashes of lightning, strike the inventor's mind, and are forthwith ready to form the subjects of applications for letters patent. That such thoughts do occasionally flash upon the inventive mind in a sudden and very perfect manner is not to be denied; but that they are not, as a rule, arrived at without long and laborious study, and often at enormous cost, might easily be proved. Is it, then, either just or reasonable to expect that men of talent would sacrifice their time and labour, and frequently likewise their health, in attaining objects from which, when arrived at, they were to receive no special benefit?

Many great thinkers—Adam Smith, Jeremy Bentham, and John Stuart Mill among their number—have thought the subject out and arrived at the one uniform conclusion. Adam Smith, in the infancy of manufacture, and Mill, in a time when scientific detail had reached a refinement which could hardly have been grasped by the minds of the preceding generation, both came, in different states of society, to the conclusion that a limited monopoly was the easiest and most practical way of rewarding an inventor. Bentham tells us that in his opinion an exclusive privilege is absolutely necessary for the encouragement of invention; and Mill, who scornfully exposed the fallacy of the argument that a patent law is in opposition to the doctrine of free trade, pronounces in favour of the limited monopoly in the invention as the best reward, because it leaves nothing to anyone's discretion, because the reward conferred by it depends upon the invention being found useful—and the greater the usefulness the greater the reward—and because it is paid by the very persons to whom the service is rendered, the consumers of the commodity.

It will be useful to inventors to know that the Patents Act of 1883 and the rules can be obtained from 38 Curator Street, Chancery Lane, W.C.; also that the Patent Office, 25 Southampton Buildings, W.C., is open from ten to four every day except Sundays and public holidays. Complete specifications of existing and old patents are kept on sale there; and an old specification is often useful as a guide to the inventor in drawing up his own. A register of patents is kept at the office, which is open to the public. There is also a library, which is free to the public, where all the publications of the office are to be

seen, and also the leading British and foreign scientific journals and text-books in various departments of science and art.

LETTERS PATENT, issued by the crown, granting any honour of dignity, cost for a duke, £350; a marquis, £300; an earl, £250; a viscount, £200; a baron, £150; a baronet, £100; for any other honour or dignity, £50. Letters Patent, authorizing a change of surname or arms, cost £50 if the change be made in accordance with will; if the change be made voluntarily, £10.

PATENT MEDICINES are certain preparations vended for the cure of disease, which have their titles registered and protected in favour of their proprietors, and upon which a stamp duty is levied by the government. Formerly such articles could only be sold after the grant of special letters patent, but by the Act 52 Geo. III. the system was altered in favour of stamp duties. The schedule of the Act gives as a list of articles liable to duty, "Foreign medicines of all kinds except drugs, and also all other pills, powders, lozenges, tinctures, potions, cordials, electuaries, plasters, unguents, salves, ointments, drops, lotions, oils, spirits, medicated herbs and waters, chemical and official preparations whatsoever, to be used or applied internally or externally as medicines or medicaments, . . . made, prepared, uttered, vended, or exposed to sale by any person or persons whatsoever, wherein the person making, preparing, uttering, vending, or exposing to sale the same hath, or claims to have, any occult art or secret for making or preparing the same." In accordance with this Act, any person vending a preparation for the cure of any complaint, who labels it as being prepared only by himself, renders it liable to stamp duty. The duties at present charged are for prices not exceeding 1s., 1½d.; not exceeding 2s., 6d., 3d.; not exceeding 4s., 6d.; not exceeding 10s., 1s., &c. Dealers in patent medicines are also required to take out an annual license at a cost of 5s.

In connection with this part of the subject, it cannot be too widely known that the government stamp affords no guarantee whatsoever either as to the wholesomeness or value of the compound sold. Unscrupulous quacks very frequently lay great stress upon the government stamp, with a view of deluding ignorant purchasers into believing the government is in some way responsible for the medicine, but such a notion is entirely erroneous. Most of the preparations sold in this way consist of very simple combinations of drugs in regular use by the medical profession, and the only disadvantage to the purchaser is that he pays for the articles a price very much in excess of their normal value. Thus certain pills which perhaps were more largely advertised than any similar medicine in the world, were merely made up of aloes, jalap, ginger, myrrh, and mucilage. The advertising, however, gave them an enormous sale, and the proprietor acquired a very large fortune. There are other preparations, however, of a more dangerous character, inasmuch as they contain very powerful ingredients which certainly ought never to be taken except under medical supervision, and of which an excessive dose would quickly prove fatal. By the Pharmacy Act of 1868, very stringent restrictions were placed on the sale of poisons, but for certain reasons the provisions of the Act were not extended to patent medicines. Another danger exists in the fact that many of the patent medicines advertised for the relief of pain, &c., contain opium and other narcotics, and thus persons using them may become the slaves to a pernicious habit without any direct intention, and indeed, without being aware of what they are doing. In a debate on the subject of patent medicines which took place in the House of Commons in 1882, Dr. Farquharson among other illustrations referred to a widely advertised compound, which, though it appeared from its title to be merely a simple preparation from an innocuous plant, yet contained a large quantity of morphia, and that some painful cases of poison-

ing had resulted from its use. Other evils arising from the present widespread traffic in patent medicines might be pointed out, but sufficient has been said to show that an amendment of the law by which it is regulated is urgently required.

PATER NOSTER (Lat., "Our Father"), the first two words of the Lord's prayer, generally used by Roman Catholics as a name for the whole. Two forms of this prayer are given in the New Testament, one in Matt. vi. 9-13, and another in Luke xi. 1-4. The Pater Noster received a place in all the ancient liturgies as well as in those of later date, and it has ever been held in peculiar reverence and regarded as a model of Christian prayer by the whole church. It would seem also that at a very early period it became customary to repeat as a doxology at the close of the prayer the words beginning "for thine is the kingdom," &c., and these words were afterwards inserted as part of the prayer in the MSS. of the gospels. They are included in the prayer in the Authorized Version, but in the revision completed in 1881 they were removed to the margin. Protestants, following the form which until recently was given in the New Testament, universally use the doxology with the Pater Noster, but in the Roman Catholic Church the prayer concludes with the clause "sed libera nos a malo (but deliver us from evil), amen." By the discipline of the church during the patristic period catechumens were forbidden to use the Pater Noster until they had received baptism. From this circumstance it was termed "the prayer of the faithful," and from its use in the Eucharist, the morning and evening services in the churches, and in private devotion it received the name of "the daily prayer." By the Apostolic Constitutions, which were probably compiled about the end of the third century, believers were directed to use the prayer three times a day. A detailed exposition of the Pater Noster with suitable comments forms part of the Roman Catholic catechism of the Council of Trent. In the Rosary the Pater Noster is united with the Ave Maria, the beads for marking the Pater Noster being larger than the others, whence they are sometimes called Pater Nosters.

PATERA, a very shallow circular cup or bowl of earthenware, or of metal, used by the ancients. Patera were made for all kinds of uses, from those red earthen specimens used for cooking, as found at Pompeii, to those in embossed bronze for drinking, and to the exquisitely shaped silver sacrificial cups for libations, sometimes ornamented with gems. The patera (Gr. *phiale*) must be distinguished from the patina (Gr. *lekane*), which was a flat dish with raised rim, usually made of earthenware, and serving to hold meat or fish at the banquet. Patinae were sometimes made of silver with very rich persons. A patina used at one of the monumental feasts of the gluttonous Vitellius was of enormous size and cost a million sestertii. The *patella*, a diminutive of patina, exactly corresponds to our plate, which is in fact a small dish.

PATHOLOGY (Gr. *pathos*, disease, and *logos*, a discourse) is the science of diseases, and especially of those which affect men and animals that are the subjects of medical treatment.

For the perfect knowledge of the nature of a disease, the first circumstance to be determined is its cause; and this is commonly regarded as twofold. The predisposing cause or condition (for the term cause cannot fairly be used in this sense) is that state of any individual which renders him peculiarly liable to the attack of any or of some particular disease, of which another person or he himself at another time might be in little danger.

Of these predisposing conditions, the most important are hereditary disposition and those peculiarities of constitution which are acquired in the course of life by particular modes of living. There are also local peculiarities of individual organs of the body which render them especially

liable to disease; such are the state bordering upon disease which is brought on by constant over-excitement of any organ; the condition of an organ which has once been affected with a disease, and which is commonly thenceforward particularly liable to a repetition of it; the state of the organs which at different periods of life renders one more than another liable to disease, so that the same excitant will be most likely to produce in the child an affection of the head, in the youth a disease of the chest, and in the adult or old person some disorder of the abdominal organs.

Next to the predisposing causes of disease are to be considered the exciting causes, which consist of any changes of a certain extent in the human subject's external circumstances. For example, a certain range of external temperature, a certain constitution of the atmosphere, a certain supply of pure food and drink, a certain amount of mental and bodily exertion, are conditions essential to health, and alterations in any of them may produce disease, of which the nature and the seat will be determined in part by the predisposition of each individual, and in part by the peculiar mode of action of the excitant. Thus, after the same exciting cause (for example, exposure to cold and damp), one person may have rheumatism, another pleurisy, and a third ophthalmia, while a fourth may escape altogether unharmed. But there are other excitants which prevail over all predisposition, and produce a certain character of disease, which the constitution of the patient can only slightly modify; such are the materials of all contagious and epidemic disorders, as influenza, cholera, small pox, measles, &c., which produce in all whom they attack a similar affection.

The nature of a disease being determined by the condition of the individual and the exciting cause to which he is exposed, the next division of pathology is the study of the symptoms or signs by which the progress of the disease is marked, and by which in practice its nature is to be determined. Of these signs many are expressive of the altered condition of the part chiefly affected, as pain in a wound or a local inflammation, coughing in a disease of the lungs, sickness in a disorder of the stomach; but a greater number are the expressions of an affection of the organs which suffer in association with those primarily diseased; such are pain in the head when the digestion is disordered, coughing in diseases of the liver, and sickness after violent blows on the head.

Whether directly or indirectly produced, all the symptoms of disease are only the perversions of the natural functions of the part affected, or appreciable changes in its structure. Their value and meaning, therefore, can only be determined by a comparison with the same functions and structure in health; in other words, this, like all other parts of pathology, cannot be rightly studied without a constant reference to physiology—for a due performance of all the functions of organic life, a healthy structure of each organ, and a healthy composition of the blood, on which they all act and all depend for their own maintenance, are alike necessary.

The recovery from disease is an example of the exercise of that power by which the body can make unusual efforts to prevent its own destruction; this has been called the *vis medicatrix nature*, or "curative force of nature." The recovery from disease is rarely perfect. Although no visible change may be left behind, yet the part diseased is frequently for ever after weak, that is, more than usually liable to the same or to some other disease. The period occupied in the progress of a disease to recovery or death is the basis of the chief division of acute and chronic diseases. The severity of the symptoms may in both cases be the same, but in general those of chronic cases are less prominent than those of acute cases.

When the disease terminates fatally, or when death takes

place from causes which occurred at a distant period, we obtain perhaps the most valuable, because the most certain, part of pathological knowledge, that of the material effects which the morbid process has produced. This, the study of morbid anatomy, is often specially called pathology. The practical value of this knowledge is the power which it affords of determining during life the nature of each disease, and the appropriate remedy for each.

PATMOS, a small island, one of the Sporades, near the south-western coast of Asia Minor, about 30 miles

south of Samos, now called Patimo. It is chiefly known as having been the place of exile of the apostle St. John, who here wrote his Revelation. The island is a continuous rock about 15 miles in circumference, for the most part rugged and barren; the coast is high, and forms many capes, with several good harbours. The population is about 4000, all Greeks, and mostly seafaring people. In the middle of the only town in the island is the monastery of St. John, which was built by Alexios Komnenos. It is a massive building flanked with towers, and looks like a



Patmos.

fortress. About half-way up the mountain, between Ia Seala and the town, is a natural grotto, in which the natives say that St. John wrote his Revelation; they have built a small church over it.

PAT'NA, a division or commissionership under the jurisdiction of the lieutenant-governor of Bengal, lying between $24^{\circ} 17'$ and $27^{\circ} 29'$ N. lat., and between $83^{\circ} 23'$ and $86^{\circ} 46'$ E. lon. The division is bounded on the north by Nepal; on the east by Bhagalpur and Monghyr; on the south by Lohardaga and Hazaribagh districts; and on the west by the districts of Mirzapur, Ghazipur, and Gorakhpur in the North-western Provinces. The area is 23,726 square miles, and the population 13,500,000.

PATNA, a district in the above division, with an area of 2100 square miles, and a population of 1,600,000. It is bounded on the north by the river Ganges, on the east by Monghyr, on the south by Gaya, and on the west by the river Son. The chief town is Patna, which adjoins on the east the administrative headquarters at Bankipur, and is situated on the south or right bank of the Ganges.

The district is, throughout the greater part of its extent, a dead level; but towards the south the ground rises into hills. The soil is for the most part alluvial; and the country along the bank of the Ganges is peculiarly fertile, producing the finest crops of all descriptions. The general line of drainage is from west to east; and high ground along the south of the Ganges forces back the rivers flowing from the district of Gaya. The result is that, during the rains, nearly the whole interior of the district south of

a line drawn parallel to the Ganges, and 4 or 5 miles from its bank, is flooded. The chief rivers are the Ganges and the Son, which form, as has been said, the northern and western boundaries of the district respectively. The total length of the Ganges along the boundary of Patna District is 93 miles. The Son first touches the district near Mahibulipur village, and flows in a northerly direction for 41 miles, till it joins the Ganges; during this part of its course it receives no tributaries. Great changes have from time to time taken place in the course of the Ganges, and the point at which the Son joined this river was once several miles east of its present position. [See GANGES.] Large game is not abundant in Patna District, there being no jungles except on the Rajagriha Hills. Among these hills bears are found. Wolves and jackals are common, hyænas are sometimes seen, and the small Indian fox is not unknown. Of smaller game, duck, quail, and ortolan are abundant; and partridges and wild geese are also found.

Rice, which forms the staple of the district, is divided into two great crops—the *kartika* or early rice, sown broadcast in June or July, and reaped in October or November; and the *aghani* or winter rice, sown after the commencement of the rains, and cut in November or December. The *boro* or spring rice is also cultivated to a limited extent, being sown in November or December and reaped in April or May. By far the most important of these is the *aghani* crop, of which forty-six varieties are named. This rice is sown broadcast on land which has been previously ploughed three or four times, and after a

month or six weeks, when the seedlings are about a foot high, they are generally transplanted; the crop requires irrigation. Among the other principal crops of the district are wheat and barley, *khesari*, grain, peas, cotton, tobacco, sugar-cane, a little indigo and mustard, several other oil-producing plants, and poppy. The last-named crop is one of the most important in the district. All the poppy grown in the province of Behar is manufactured at Patna city. Wages are low in Patna as compared with Bengal generally. Coolies are paid at the rate of 3*d.* a day; agricultural labourers are generally paid in grain, representing a money wage of about 1*d.* or 1½*d.* a day; smiths and carpenters earn from 3½*d.* to 6*d.* a day.

Patna is subject to blights, floods, and droughts. Blights occur seldom, and on a small scale. Floods are caused by the overflowing of the Ganges and the Son; they are of frequent occurrence, but usually cause only partial damage. The East Indian Railway traverses the whole length of the district, entering it at Barhiya station, and leaving it at the Son bridge, a distance of 86 miles.

The climate of Patna is considered remarkably healthy. The prevailing winds are east and west, in almost equal proportion; both winds are hot and parching. The average annual rainfall is 35·66 inches. The prevailing endemic diseases of the district are cholera in and about the city of Patna, and stone in the bladder, chiefly among the Gouda caste. Small-pox and fever are also prevalent.

PATNA CITY (known to the natives as *Asimabad*) is the chief city of above district, situated on the right or south bank of the Ganges; and adjoining on the east Bankipur, the civil station and administrative headquarters of the district. As regards population, Patna is the sixth city of India, containing 160,000 inhabitants. The city of Patna includes the suburb of Bankipur on the west, and Jafar Khan's garden on the east, an extent of nearly 9 miles along the bank of the Ganges. The width, from the bank of the Ganges, is on an average about 2 miles; so that the whole circumference includes an area of about 18 square miles. The city proper within the walls is rather more than a mile and a half from east to west, and three-quarters of a mile from north to south. It is very closely built, many of the houses being of brick; the majority, however, are composed of mud with tiled roofs, and very few are thatched. There is one fairly wide street, running from the eastern to the western gate, but it is by no means straight or regularly built. Every other passage is narrow, crooked, and irregular; and it would be difficult to imagine a more unattractive place. Still, every native who can afford it has a house in this quarter. In the dry weather the dust is beyond belief, and in the rains every place is covered with mud, while in one quarter there is a large pond which becomes very offensive as it dries up. The fortifications which surround the city have long been neglected, and are wretched to the last degree.

The Patna College is a fine brick building, at the west end of the city. Originally built by a native for a private residence, it was purchased by government and converted into courts for the administration of justice. In 1857 the courts were removed to the present buildings at Bankipur, and in 1862 the college was established in its present place. In spite of the antiquity of Patna, the total absence of ancient edifices is not to be wondered at, for quite modern buildings easily fall into decay.

The trade of the district centres in Patna city, which is, next to Calcutta, the largest river-mart in Bengal. Its central position at the junction of three great rivers, the Son, the Gandak, and the Ganges, where the traffic of the North-western Provinces meets that of Bengal, gives it great natural advantages. It is also conveniently situated for the purpose of transport, either by river or railway, having a river frontage during the rains of from 7 to 8 miles, and in the dry months of 4 miles.

There are scarcely twenty persons in the city to whom the term "merchant" can be strictly applied—that is, wholesale dealers with headquarters in the city and agencies at out-stations, who carry on an import and export business entirely on their own account. The bulk of the so-called merchants are, properly speaking, merely commission agents; and the general practice is for *bejaris* to bring merchandise to these agents, at a storehouse, termed an *arat*, where the grain is sold, the agent or *aradidar* merely receiving a certain percentage. In this manner, a considerable import trade passes through the hands of the *aradidars* into those of the wholesale exporting merchants. It is said that nine-tenths of the oil-seeds and food grains, when brought into the city, are deposited in some *arat*, where they are taken over by the *aradidar* on his own account at the then prevailing rates. Taking the trade as a whole, it may be laid down that most articles are passed on through the city from one mart to another. Thus, to take the important staple of oil-seeds, large quantities are landed at Colonelganj, where they are purchased by Maharaigjanj merchants, who in their turn sell to merchants of some other mart, and so on till the goods finally reach the hands of the exporting merchant for despatch to Calcutta.

PATOIS is often confounded with DIALECT, from which it is very sharply distinguished. A dialect is a form of a language, and often various dialects are of equal importance for a long time, though eventually one is sure to lord it over the others, as the Attic over the Ionic and Doric in ancient Greece. But a patois is not a language in the full sense of the term. It exists only in the speech of the illiterate, it has no literature. Patois is by no means a corruption of a once perfect literary language; it is, on the contrary, an incipient dialect nipped in the bud, or the remains of a dialect crushed out of existence by other dialects. It follows from this that the study of patois is one of the most fruitful and absorbing studies of the philologist.

PATRAS, the ancient *Patra*, a fortified seaport town of Greece, and the principal seat of its foreign trade, is on the north coast of the Morea, about 6 miles south-west of the entrance of the Gulf of Lepanto. The population in 1884 was 25,494. The modern town occupies a portion of the low and unhealthy plain between Mount Voldhia and the sea; and also the ridge of which the acropolis or citadel crowns the summit, commanding a fine view of the fertile plain which stretches along the sea-coast. A ruined Roman aqueduct is one of the few relics of antiquity. The principal trade is in currants of the best quality, large quantities of which are raised in the plain of Patras and all along the north shore of the Morea. The hills are planted with vines, from which a good red wine is made; and considerable quantities of resin are procured from the neighbourhood. Many of the houses in the town are surrounded by gardens, with orange, fig, pomegranate, and other fruit trees; but the dwellings themselves are ill built, mostly of wood, and only one storey in height, on account of the frequency of earthquakes. One of the churches is traditionally connected with the martyrdom of St. Andrew, and is greatly resorted to by devotees. The old harbour, though protected by a mole, is unsafe and exposed to heavy seas, particularly in winter, but extensive new works are in course of construction. Capotes, made of wool and goats' hair, are manufactured in the town. A good market was built by the municipality in 1868. At Patras, in 1821, the standard of revolution was first raised in the Morea.

PA'TRIARCH (Gr. *patriarchēs*, the head of a tribe) is a name applied in the New Testament to Abraham (Heb. vii. 4), to the sons of Jacob (Acts vii. 8, 9), and to David (Acts ii. 29). It corresponds to the Hebrew term *Koshe Aboth*, applied in the Old Testament to the princes

of the tribes or heads of the families, and it is used in this sense in the Septuagint. In reference to Old Testament history the term is commonly used for the ten descendants of Adam down to Noah, given in "the book of the generations of Adam" (Gen. v.), the antediluvian patriarchs, and for the descendants of Noah down to Terah, as well as for the immediate ancestors of the Hebrews already referred to. In the Christian church the title was assumed by the bishops of the principal metropolitan sees, such as Rome, Constantinople, Alexandria, Antioch, and Jerusalem, who were superior to archbishops or metropolitans, and ruled over several provinces. In the main the authority of a patriarch resembled that of a metropolitan, but it represented a superior dignity and extended over the metropolitans themselves. After the division had become established between the Eastern and Western parts of the church, the Roman Catholic branch, in support of its claims, continued to elect some of its prelates to the title and rank of patriarch of the Eastern sees, and though their authority has never been recognized in the East, the series has been continued to the present day.

PATRIARCHAL THEORY, that theory of the origin of society which refers it to a patriarchal community: such as that of ancient Rome, described fully in the article *FAMILY*, or such as that of the ancient Jews as recorded in the Bible. This once universal view now yearly becomes more discredited as the present habits of savages and the ancient laws of such communities as the Slavonic, Hindu, and old-Irish nations are painfully studied out and elucidated. The modern view represents the family, as has been elsewhere shown in the present work [see *FAMILY*] as a result, not a cause, of society. The subject is exhaustively discussed, and once for all disposed of in the "Patriarchal Theory" of McLennan (London, 1885).

PATRICIAN OF THE ROMANS, a title borne by the Roman viceroy of the Byzantine emperors. The title was revived by Pope Stephen III. (754), and conferred upon the Frank king Pipin, in return for his "donation" which founded the temporal sovereignty of the popes. At the decay of the Carolingian Frankish line the Byzantine emperors were able to regain much of Lombardy, and Naples as well, and over these a patrician was set, whose title was afterwards changed to *catapan*. The secular government of Rome by the patrician and the ecclesiastical government by the Pope went on until the office of patrician was abolished by Pope Eugenius III. in 1145.

PATRICIANS (Lat. *Patres, Patricii*) was the appellation of the members of the original gentes, or clans, of which the Roman burghess-roll, the ruling power in the community, was at first composed; and of their descendants either by blood or adoption. The gentes are said to have been 300. Each gens comprised several families, which were distinguished by a surname, in addition to the name of the gens. Thus the gens Cornelia comprised the families of the Scipiones, the Lentuli, the Sullæ, &c. For a long time marriage with others than patricians was illegal for this rigidly separated community. The great growth of the city did not therefore affect their own number in the least; and all others than themselves, that is, the great majority of the people, were called the *plebs*. The members of the senate, the consuls, and the pontifices were exclusively chosen from the patricians until B.C. 367. Non-patricians (plebeians) were admitted to a share in the civic rights at this time. The patricians then became an exclusive aristocracy, and made up in pride for what they lost in power.

PATRICK, ST., the Apostle of Ireland, was born about the year 387, of Christian parents, at Bonavem Tabernia, a village identified by tradition with a place on the estuary of the Clyde (called from him Kilpatrick) near Dumbarton. He came of a family that had already sustained several offices in the church—his father, Calpornius,

like his great-grandfather, being a deacon, while his grandfather had been a priest. He was already ordained deacon when in his sixteenth year, in one of the forays with which the Irish harassed Western Scotland, he was taken prisoner and carried to the north of Ireland, where he was kept a slave for six years, being employed as a shepherd. At the end of this period he managed to escape and rejoin his parents, and while with them he resolved to devote himself to the work of evangelizing the land of his captivity. Before entering upon his mission he prepared himself by study, visiting, it is said, Germanus, bishop of Auxerre, and St. Martin of Tours; and after receiving ordination, residing for some time among the monks of Lérins in the Tuscan Sea. He then sailed for Ireland and commenced his labours, and though they were received with much opposition, and attended at first with very little success, he steadily persevered until the tide turned in his favour. He appears to have possessed much sagacity, and by addressing himself first to the chieftains, and then utilizing their influence with their clans, he secured a large number of converts. At the age of forty-six he was ordained bishop, and in 455 he founded the church and see of Armagh. After this he spent the rest of his days in Ulster, and died at a place called Saul near Downpatrick, his relics being preserved at the latter place until the period of the Reformation. The Bollandists place the date of his death at 460, but there is much uncertainty respecting it, and the estimates of his biographers vary considerably upon this point. His festival falls on the 17th of March.

The chief sources of the information we possess concerning St. Patrick are two writings which profess to come from his hand, entitled "Epistola ad Caroticum" and the "Confessio"—rude Latin documents, of unquestionably high antiquity. The letter to Caroticus has reference to a foray of this Welsh chieftain upon the Irish coast, in which a number of Christian neophytes had been carried off into slavery. The Confession, which gives most of the particulars known respecting his life and work, appears to have been written shortly before his death. There has been some controversy as to the genuineness of this document; but both pieces possess all the characteristics of the time and place, and no good reason has been advanced against their acceptance. Of legendary memoirs of St. Patrick there is a continuous series from the seventh to the twelfth century, the "Annotations" of Bishop Tirechan being the most ancient. Of modern works the most important are the biographies of St. Patrick by the Rev. J. H. Todd (1 vol. 8vo, Dublin, 1863), and Miss Cusack (Kenmare, 1877). See also vol. ii. of Skene's "Celtic Scotland" (Edinburgh, 1877).

PATRICK, ORDER OF ST., the Irish national order of knighthood, founded by George III. in 1783, and composed of the sovereign, a prince of the blood-royal, a grand-master (the lord-lieutenant of Ireland *ex officio*), and fifteen knights. The motto is *Quis separabit?* ("Who shall separate us?"), the ribbon sky-blue, the star circular, and the mantle of a rich sky-blue satinet, lined with white silk. The collar (of gold) consists of roses alternating with harps, laid together with a knot of gold. By the statutes of 1883 the number of knights was increased to twenty-two. The order is indicated by the initials K.P. See *ORDERS OF MERIT*.

PATRIPASSIANS (Lat. *pater*, father; and *passus*, suffered), the name given by their opponents to a small sect of Christians said to have been founded by Praxeas, a native of Phrygia, who lived at the end of the second century. Very little is known respecting their doctrines, but they appear to have agreed in the main with those afterwards termed Sabellian. The characteristic feature in this belief was that there was but one person or hypostasis in the Godhead, and the name Patripassians was a nickname founded upon what their opponents regarded as an

absurd consequence necessarily derived from their teaching, viz. that when Jesus died upon the cross, it was also the Father who was crucified. Their proper name was "Monarchians," from the Greek *monos*, one, and *arché*, principle. The sect appears to have been chiefly known at Rome, but it never attained any special power or importance.

PATROKLOS (Lat. *Patroclus*), the famous friend of his kinsman Achilles in the siege of Troy, was son of Menoitios. In a boyish scuffle he had the misfortune to kill his adversary, and fled with his father to his relative Pélus, the father of Achilles. Pélus received him kindly, and had him educated with his own son. The boys became fast friends, and their love for each other has passed into a proverb. In fact it cost both of them their lives, for after Achilles had retired from active conduct of the war against Troy, because of the tyranny of Agamemnon, the commander of the expedition, Patroklos begged him for his armour on one occasion when the Greeks were hard pressed and a disaster was evidently impending. His design was to frighten the Trojans by appearing in the well-known arms. Achilles complied, and the trick was but too successful. Not only were the Greeks encouraged by the return of their favourite hero (as they thought) to drive the Trojans back, and to put out the flames which threatened their encampment round the ships, but they followed Patroklos, against the orders of Achilles, to the very walls of Troy. This was more than the gods of the Trojan party could bear, knowing that the success was one of mere prestige only. Therefore Apollo himself condescended to overthrow Patroklos, who was immediately run through the body and despatched by Hektor. The latter proceeded to despoil Patroklos of the armour of Achilles. One of the fiercest fights in the war now ensued over the body of Patroklos; eventually the Greeks regained it, and Achilles solemnly burned it with funeral games and every possible mark of honour. Then he returned to the field and avenged his friend by the death of Hektor at his hands, himself soon after to fall, however, by a bow-shot from the effeminate Paris.

PATROL is a strong body of soldiers employed to promenade the lines of defence of a besieged fortress, and to watch the enemy. In a garrison town or camp, a patrol comprises five or six soldiers, under the command of a sergeant whose duty it is to patrol the streets and see that all is quiet and orderly, and to arrest those soldiers who are out without leave, or who are disorderly.

PATRON. See **BENEFICE**; **CLIENT**.

PATRONUS (Lat. *pater*, a father, as *matrona* is formed from *mater*, a mother). The relation of patron and client (*clients*) in ancient Rome is stated in the article **CLIENT**. A manumitted slave (*libertus*) stood in a new relation to his master who manumitted him; and the master was called, with respect to him, patronus. The manumitted slave received the gentile name of his patronus.

PATRONYMIC, a word which expresses the name of a person's father or ancestor. Thus Achilles is called Pteleides (the son of Pélus); Agamemnon, Atreides (the son of Atreus), &c. In the English language we have no adjectival words of this description, but in Sanskrit and Greek they are very common, especially in Sanskrit, which has as many as thirteen different terminations to form such words. Our surnames like Johnson, or its shorter form John, Richardson and Richards, &c., are in their first origin undoubtedly true patronymics. The word is only used now as synonymous with surname.

PATTERSON-BONAPARTE, MADAME ELIZABETH, the clever, handsome, and accomplished American wife of Prince Jérôme Bonaparte (king of Westphalia), was born in Baltimore, 6th February, 1785, becoming, as she grew up, the most beautiful girl in that city, always famous for its beautiful women. Her father was William Patterson, who was born at Donegal, Ireland, in

1752, of mixed Scotch and English descent. He arrived in Philadelphia quite a poor lad, in 1766, and became a clerk in a shipping-house. By sheer industry and commercial talent and integrity, he became one of the merchant princes of his time, the trusted friend of the great Washington, and the associate of Lafayette, Carroll, and Jefferson. He was of great service to the Americans in the War of Independence, through his daring in loading his vessels with arms and ammunition in France wherewith to supply the colonial army. He was the first president of the first bank of Maryland (1790), the earliest institution of its kind south of Philadelphia, and one of the most active of the original directors of the first railway in the South, the Baltimore and Ohio Railway (1832), though he was then eighty years old.

In the summer of 1803 Jérôme Bonaparte, then a captain in the French navy, visited Baltimore. Every attention was lavished on this handsome young brother of the famous First Consul. He saw Elizabeth Patterson, fell madly in love with her, found that his affection was ardently returned, and in spite of extreme measures, extending even to a temporary banishment of the young lady, on the part of Mr. Patterson, who saw the dangers his daughter ran under the iniquitous French marriage law, succeeded in marrying her. The ceremony was with great prudence made as public as possible, and was performed by Bishop Carroll, afterwards the first Roman Catholic primate of America. Mr. Patterson, still dreading that trouble might arise from the absence of the consent of the husband's family (necessary by French law), corresponded with the American minister at Paris, hoping through him to reconcile the Bonapartes to a match he had honourably striven himself to prevent, and he backed his communications by letters from the President of the United States and the chief secretary of state. He further sent to Paris his son Robert upon hearing that Napoleon was angry at the match. Robert at once advised that Jérôme should stay in America, as he found the First Consul was very determined in the matter, or that if he came to France he should bring his wife with him. Lucien Bonaparte alone approved the match, and promised to help the young couple. He also advised Jérôme to stay in America and become a citizen of the United States, unless he would prepare for trouble. But the First Consul had already decided upon his course. He peremptorily ordered Jérôme to return, and without his wife, and he forbade any French captain to "receive on board the young person to whom the Citizen Jérôme has connected himself, it being the First Consul's intention that she shall by no means come into France." He further saw to the senate passing a decree, declaring the "act of celebration of a pretended marriage that Jérôme Bonaparte has contracted in a foreign country" illegal, and forbidding any French functionary to register it or to recognize it.

In December, 1801, Napoleon was crowned emperor at Notre Dame, and in the various announcements made upon the occasion he signified that Jérôme must be regarded as not belonging to his family, and that if he landed in France he should be imprisoned until he had agreed to marry according to the will of the emperor. Nevertheless, Madame Patterson-Bonaparte did not cease to beg her husband to sail with her for Europe, feeling confident that she who had so thoroughly conquered American society could even thaw the icy heart of the emperor. In April, 1805, the Bonapartes therefore arrived at Lisbon in one of Mr. Patterson's ships. A French guard was at once set round the vessel, and Madame Bonaparte was not suffered to land. Jérôme hurried to Paris in the greatest alarm, vowing never to desert his young and lovely wife. It was long before his brother would see him, and when at length he obtained an interview he was instructed about other matters, the emperor carelessly adding, "As to your love affair with your little girl, I pay no heed to it."

Meanwhile Madame Jérôme, kept hopelessly a prisoner to her ship at Lisbon, sailed for Amsterdam by the advice of Madame Mère, the emperor's mother, who, like all the Bonapartes except Napoleon, took a great liking to the courageous lady. But on her arrival in the Texel a 64-gun ship and a frigate took up position alongside the *Erin*, and all communications with the shore were cut off. Eventually Madame Jérôme gave up the attempt and retired upon England, landing at Dover on the 19th May, 1805. So great was the curiosity to see her that Mr. Pitt favoured her with a military escort for her protection. At Camberwell, London, where she resided, her boy, Jérôme Napoleon Bonaparte, was born, 7th July, 1805. He is always called "Bo" in his mother's letters and correspondence. Pope Pius VII., appealed to by the emperor, who even sent a handsome gold tiara to assist his deliberations, declared himself unable to dissolve the marriage; but the council of state was more complaisant, and in the end Prince Jérôme, who had never ceased to write affectionately to his wife, "while protesting he would never consent, consented," and was at once forgiven by the emperor and raised to the rank of admiral. Madame Patterson-Bonaparte soon after returned to Baltimore, and heard from there of the second marriage of her husband to the Princess Frederica of Württemberg, and of his nomination as King of Westphalia. Jérôme agreed to allow his wife a pension of about £250 a year, and did in fact pay it for five or six years, after which his finances were too crippled to continue it.

In 1815, after the fall of Napoleon, Madame Patterson-Bonaparte visited England and France, and as a result in 1819 she took up her residence in Europe, for the better education of "Bo," being visited and recognized by the Bonapartes and by royal and aristocratic personages, although she always lived very quietly. She had in 1815 taken the precaution to get a divorce pronounced in Baltimore on account of the desertion of her husband, lest he should assume rights, in his downfall, over her property, which at the death of her father would be considerable. She resided chiefly at Geneva, although the Bonapartes, especially the Princess Borghese (Pauline), repeatedly offered her a home in Rome. She only once met her husband. It was in 1822, in the Pitti Palace galleries at Florence. Jérôme was with his second wife, to whom he whispered, starting back, "That is my American wife," but no words passed between him and his first wife.

In 1824 Madame Patterson-Bonaparte returned for about a year to America, whither her son had gone to finish his studies at Cambridge University, United States, but she was unable to keep away from the society of her distinguished European friends. In 1826 "Bo" joined his mother, who for about five years held a very brilliant position at Florence. The young man spent some months with his father at this time, at Rome and elsewhere, and many projects were afoot for marrying him to one or other of his princely cousins. But on his return to America he married to please himself, to the great wrath of his ambitious mother. Madame Patterson-Bonaparte returned in 1834 to Baltimore, where she spent the rest of her life, except for a visit to Paris in 1839-40. When Napoleon III. became emperor his Baltimore cousin offered her felicitations, which were cordially received; and when Mr. Jérôme Bonaparte of Baltimore visited Paris in 1854 he was complimented by receiving a declaration of his legitimate French birth from his imperial cousin's own hands, which was also published in the *Moniteur*, 30th August, 1854. The following year, 1855, Napoleon III. desired to create Mr. Jérôme Bonaparte duke of Sartène, but as he feared this would infringe his right as the eldest son of his father he declined the honour. On the other hand, Prince Jérôme, his father, protested against the conduct of Napoleon III., and induced him greatly to modify the favourable line he had at first adopted to his Baltimore

cousin; and on the prince's death in 1860 it was found that his eldest son by his second marriage (commonly called Prince Napoleon) was named his heir, no mention whatever being made of the first-born American son. Against this injustice Madame Patterson-Bonaparte loudly protested, and the great Berryer pleaded her cause at law. It was, however, lost, and the Baltimore Bonapartes, though recognized as legitimate, were denied all claims to imperial rank. Madame Bonaparte died at Baltimore, 4th April, 1879, having completed her ninety-fourth year in the previous February. It may be added that her sister-in-law, Mrs. Robert Patterson (Miss Mary Carroll), married *en secondes nocces* (1825) the Marquis of Wellesley, then a widower of sixty-five years of age, the elder brother of the great Duke of Wellington, and lord-lieutenant of Ireland at the time. It is at the least odd that of two sisters-in-law one should marry the brother of Napoleon and the other the brother of Wellington. (See the interesting "Life and Letters of Madame Bonaparte," by Didier, London, 1879.)

PAU, the capital of the French department of Basses-Pyrénées, stands on the right bank of the Gave-de-Pau, 468 miles south-west from Paris, and had 29,971 inhabitants in 1882. The town is situated on a height, and is divided into two parts by a deep ravine crossed by a bridge. It is well laid out. The principal object of interest is the ancient royal castle, the birthplace of Henry IV., on the west side of the town. This building is an irregular Gothic structure, striking from its vastness and interesting from its historical associations. The room in which Henry was born is still shown. The castle, which commands a beautiful and extensive prospect, and has a fine park attached to it, was for a part of the year 1848 the prison-residence of the Arab chief Abd-el-Kader. Pau was also the birthplace of Gaston de Foix and of General Bernadotte, afterwards King of Sweden. It was the capital of the old province of Bearn. There are two handsome squares, called La Comédie and La Place-Royale; the latter is planted with trees, and adorned with a fine pedestrian bronze statue of Henry IV. There is a good bridge over the Gave-de-Pau, leading to the neighbouring town of Jurançon, celebrated for its wines. This bridge has seven arches, and is remarkable for its elevation. There are also a court-house, a market-house, with a fountain in front of it, and several fine promenades. The town is the seat of an imperial court, and civil and commercial tribunals; has a public library containing 20,000 volumes, and a national college. The principal manufactures are carpets, linen, handkerchiefs, leather, and table-covers. Trade is carried on in hams, salted legs of gress, Jurançon wine, chestnuts, cotton yarn, cotton goods, and coarse woollens. Pau commands most magnificent views of the Western Pyrenees, and from its wild scenery and mild climate it is a great resort of foreign visitors and invalids, especially in winter. The mean temperature of the year is 56° in summer, 70°; and in winter, 41° Fahr.

PAUL was the name assumed by five of the popes.

PAUL I. (St.), reigned from 767 to 767. He succeeded Stephen III. and preceded Stephen IV. His reign was remarkable for the close friendship between the Roman see and the Frankish kingdom, then ruled by Pipin. Paul also endeavoured to reconcile the feud with the Byzantine emperors, known as the iconoclastic controversy.

PAUL II. (1464-71), a Venetian, whose name was Pietro Barbo, succeeded Pius II. and preceded Sixtus IV. His family connection with several of the popes raised him to rapid promotion in the church, and he was a cardinal at twenty-two and pope at forty-six. Paul II. was a handsome, worldly, somewhat ostentatious man, and divided his time between improving the clerical costumes and amusing the people with shows. The horse-races he founded in the Corso have existed down to our own day. A worse side of his pontificate was the steady persecution of men of

letters, perhaps due to his own little culture. He died of apoplexy.

PAUL III. (1534-49), a Roman, whose name, Alessandro Farnese, sufficiently shows his high birth, owed his advancement, in the first instance, to the admiration his lovely sister kindled in the Borgia-pope, Alexander VI. He was a cardinal at twenty-five, and received the nickname of "the Petticoat Cardinal" in consequence. But his own great merits and simple amiable character conduced the means of his elevation, and throughout his life he was loved and esteemed by all. Very few popes, indeed, were so universally regretted as Paul III. when he died, broken-hearted at the ingratitude of his grandsons, who were actually in arms against him. Tender-hearted as he was, Paul III. had great force of character, and skillfully guided the church in a difficult time. His own temperament lay far more with the joyous renaissance than with the stern reforming tendencies of the time. Yet his position, succeeding Pope Clement VII., under whom first North Germany and then England had split off for ever from Rome, threw him into the arms of the earnest party at Rome. Slavery was formally condemned in 1537, the order of the Jesuits was instituted in 1540, the Roman Inquisition in 1542, Protestantism was soon driven wholly out of Italy; and finally, the great Council of Trent, which was to reform the whole church, was called in 1545. It might be added to this that Michelangelo's "Last Judgment" was completed. Nevertheless Paul's sympathies, well as he did his work, and famous as he is for his wise nominations of cardinals and ministers, lay elsewhere. One of his chief desires was to aggrandize his family. He alienated Parma and Piacenza from the church, for instance, creating of them a duchy whereof his son Pierluigi was the first duke. (Pierluigi was assassinated, apparently with only too complete a cause for the crime, in 1547.) Paul III. took advantage of a time of trouble and a disputed succession to seize the territory of Camerino, which he bestowed on his grandson Ottavio; and he negotiated marriages for his grandson Ottavio with Margaret, the illegitimate daughter of the Emperor Charles V., and for his grand-daughter, Vittoria, with a prince of the blood of France, the Duc de Vendôme. The latter alliance was never actually formed; but in its stead Paul's grandson Orazio married a daughter of Henry II. of France. These dynastic projects seem odd to read of in connection with a pope; but the state of manners at the time was such that even Paul's considerable family did not excite much remark. Paul III. was a somewhat learned man, loved science such as it was in his time, and was a kind friend to men of letters. He succeeded Clement VII. and preceded Julius III.

PAUL IV. (1555-59), a Roman, whose name was Giovanni Pietro Caraffa, was chamberlain to Alexander VI. (Borgia), and afterwards nuncio to England and Spain. Nevertheless in 1524 he retired from the world to his archbishopric of Theate or Chieti, resigned the see, sold all he possessed for the poor, and founded the rigorous Order of Theatines. Paul III. drew him back to activity in 1536 by creating him a cardinal, and he at once headed the reactionary party. He was feared as much as respected, but he was so evidently in earnest that notwithstanding his age (seventy-nine) and the formal prohibition of Charles V., on the death of Marcellus II. he was unanimously elected pope. His stern temper led him into many errors, varied by clumsy abortive attempts to remove the unpopularity which pursued him. He was the most impracticable pope since Urban VI., and the whole of the few years of his reign were filled with quarrels. Paul IV. was the first pope to issue a complete Index Expurgatorius. Pius IV. succeeded him.

PAUL V. (1605-21), a Siennese by descent and a Roman by birth, whose name was Camillo Borghese, was born in

1552, became cardinal 1596, and pope 1605. He succeeded Leo XI. and preceded Gregory XV. The conclave had been very stormy, and Cardinal Borghese was at last elected as being an amiable man who would conciliate all parties. The conclave was much mistaken. The new pope proved a harsh master, imperious, domineering, ambitious, and rigid in discipline. He went so far as to excommunicate the whole of Venice for a breach of ecclesiastical discipline. The only result was that the Venetians, who merely claimed the right to try their prisoners, ecclesiastical as well as other, before the regular tribunals, dismissed all the clergy who paid any attention to the Pope's mandate (1606). After a controversy of prodigious dimensions the Pope had to confess himself beaten, and permit the King of France to negotiate a compromise for him (1607), having accomplished the disastrous result of showing completely to the world that the powerful ecclesiastical weapon which had once shaken the world was now a terror to no one, and would hereafter have to be laid aside.

The towering energy of Paul V. repressed on the political side, fortunately turned to calmer fields. He devoted the rest of his reign beyond earnest church propaganda and missionary work to the embellishment of Rome, enlarging the Vatican and the Quirinal palaces, building the Borghese Chapel in S.M. Maggiore, completing the nave, façade, and portico of St. Peter's, collecting paintings and sculpture, and constructing new streets and fountains.

PAUL, ST., the great apostle of the Gentiles, was born at Tarsus, an important city of Cilicia. The date of his birth is unknown, but it is generally placed some two or three years later than the birth of Jesus. He came of pure Jewish stock, of the tribe of Benjamin (Phil. iii. 5), his father being a Pharisee, who had by some unknown means acquired Roman citizenship (Acts xxii. 25-28; xxiii. 6). Tarsus was at that period a city of considerable commerce, and one that was famed for its educational advantages, being compared by Strabo in the latter respect to Athens and Alexandria. He appears to have spent his boyhood and to have acquired an elementary education at this city, being also instructed in the trade of weaving goat's hair into tent cloth in accordance with an injunction of the rabbis that every Israelite should be instructed in some useful handicraft. It would seem that his parents were in easy circumstances, and Paul was sent when a youth to Jerusalem, the home of some members of the family (Acts xxiii. 16), to be instructed in the Jewish law, and there he became a pupil of the celebrated Gamaliel (Acts xxii. 3). In the account of the ministry of Stephen, given in Acts vi., we read that the members of the synagogue of the Cilicians were numbered among his opponents, and when Stephen was stoned, Paul, or as he is then termed Saul, assisted at the execution, and approved of what was done. This execution was the commencement of a fierce persecution of the Christians, in which Paul took a prominent part, and in the course of which he undertook a journey to Damascus, armed with authority to arrest any of the brethren he might find there and to bring them up to Jerusalem. While on the journey a remarkable incident occurred which resulted in the abandonment of his project and his acceptance of the faith he had previously laboured to destroy. Three accounts of this event are given in the book of the Acts (ix., xxii., and xxvi.), which, though irreconcilable in their details, are yet essentially the same in respect to all points of importance. His conversion was followed by a prolonged period of retirement in Arabia, concerning which nothing beyond the fact is known (Gal. i. 17), after which he returned to Damascus, where he began preaching in the synagogues that Jesus was the Messiah. This aroused the active hostility of his countrymen, and with the connivance of the ethnarch Aretas, they formed a plot for his destruction (Acts ix. 23; 2 Cor. xi. 32, 33), from which he was saved by a midnight flight over the wall

of the city. From Damascus he made his way to Jerusalem, where he was received with much suspicion by the brethren; but through the good offices of Barnabas he was introduced to Peter, with whom he stayed for a short period (Acts ix. 27; Gal. i. 18, 19). He endeavoured to continue the work he had commenced at Damascus, but his efforts aroused such a dangerous spirit of opposition that he was compelled to leave Jerusalem and return by way of Cæsarea to his native city. While he was at Tarsus the new faith began to display a remarkable development at Antioch, in Syria, where some of the Hellenists who had been compelled to flee from Jerusalem had begun to admit the Gentiles to the new community. Barnabas, who was sent by the apostles to take the oversight of the work there, sought Paul as a colleague, and after a stay in Antioch of about a year, during which their labours were attended with much success, the two friends set out on a prolonged missionary journey. In the course of this they visited Cyprus, Perga, Antioch in Asia Minor, Iconium, Lystia, and Derbe, preaching in all these places both to Jews and Gentiles, some of the incidents of the journey being recorded in Acts xiii. and xiv. After their return to Antioch they had to encounter some of the first manifestations of that spirit of Jewish bigotry in the Christian Church with which Paul had to contend during his whole life, and which did not disappear until long after his death. In his conception of the gospel Paul had risen above the narrowness of the brethren at Jerusalem, and he had admitted his Gentile converts without requiring them to become Jews. In consequence the Pharisaic party in the church sent certain emissaries to Antioch to counteract his teaching, with the result that after some sharp contention the question as to the terms of admission for Gentiles was submitted to the apostles at Jerusalem. Paul and Barnabas went up to Jerusalem to represent their party, and a council was called to consider the matter. The result of this council was that the Jewish rite of circumcision was given up so far as the Gentiles were concerned, and the new converts were merely required to conform to a few regulations prescribed to the "proselytes of the gate." It was also resolved that Paul should continue his labours among the Gentiles while the other apostles confined theirs to their own countrymen (Acts xv.; Gal. ii.). Soon after this event Paul started in company with Silas on a second missionary journey, in the course of which they passed through Asia Minor, and then entered Europe, visiting Philippi, Thessalonica, Berea, Athens, and Corinth, encountering much hostility on the part of the Jews, but leaving behind them, in nearly every place, a little band of converts. The success of the apostle was especially marked at Corinth, where he made a stay of a year and a half, maintaining himself by his trade, and where Gallio, the brother of Seneca and proconsul of Achaia, protected him on one occasion from the violence of his opponents (Acts xviii. 12-17). From Corinth he proceeded by way of Ephesus and Cæsarea to Jerusalem, returning to Antioch preparatory to setting out on a third missionary journey. This time he passed through Galatia and Phrygia, made a prolonged stay at Ephesus, where his success was of a remarkable character (Acts xix.), passed through Macedonia into Greece, and then in company with a small party of friends he returned to Syria. Among this company of friends was the evangelist Luke, whose personal notes of the subsequent movements of the apostle are accepted as authentic by critics of all schools. An interesting interview with the elders of the church at Ephesus is recorded in Acts xx., and then the apostle proceeded by sea to Patara and Tyre, and from thence he went up by way of Cæsarea to Jerusalem. On the journey he had received several warnings as to the light in which he was regarded by the Palestinian Jews, and these warnings were fully justified by the events which followed. Although the

apostles and the other members of the church appear to have been living without molestation at Jerusalem, Paul had become an object of hatred both to the orthodox Jews and the Jewish Christians. In order to appease the latter Paul accepted the observance of a Nazarite vow, which necessitated his attendance at the Temple, and while there he was recognized by some of his old opponents from Asia, who were also on a visit to Jerusalem, and he became the object of an outburst of mob violence, from which he was rescued with difficulty by the Roman guard. After an irregular hearing before the Sanhedrin, in consequence of a plot formed for his assassination he was sent away to Cæsarea. Here he remained a prisoner for about two years, and then in consequence of his appeal to Cæsar he was sent to Rome for trial. The narrative of his voyage to the latter city is given in a very minute and circumstantial manner in the book of the Acts, but the history unhappily breaks off abruptly with the arrival of the apostle at Rome, merely recording a few circumstances attending his arrival and the fact that he remained there two years, living in a hired house or lodging, preaching the gospel without molestation or hindrance. At this point all authentic history comes to an end, and the subsequent fate of the apostle has been the subject of much controversy. According to one theory he obtained liberation at the end of the two years, and resumed his missionary labours, journeying both east and west, in the latter direction going as far as Spain. Arrested and sent a second time to Rome, he suffered martyrdom about the year 67 or 68 A.D. In opposition to this view it has been maintained by many modern scholars that he was never liberated, and that his death took place at an earlier date than is commonly supposed.

For the circumstances of his life and work we are almost wholly indebted to the Acts of the Apostles and the Epistles, the traditions of the church which have any appearance of genuineness being very few. Of the writings of St. Paul there are thirteen letters ascribed to him which are preserved in the New Testament, and it is known from these that he was the author of others which are lost. Some of these letters are rich in personal allusions, and they contain references to many circumstances in the life of the apostle which are not mentioned in the Acts. For the most part they seem to have been called forth by incidental circumstances in connection with his work, they are addressed to separate churches or to individuals, and except in one or two instances (Col. iv. 16; 1 Thes. v. 27), he does not appear to have arranged for their preservation or circulation in the church. Notices of these epistles will be found under their separate headings, as also of the book of the Acts of the Apostles, but a few words may be said here in reference to certain modern theories respecting them. Until a very recent period the book of the Acts was accepted as genuine history throughout the whole church, but at the present day this view is impugned by many scholars, who, following in the path indicated by BAUR, represent it as being theological rather than historical. It is not denied that the book contains many important historical facts, but its chief aim is supposed to be the reconciling of the Jewish and the Gentile parties in the church, and that to accomplish this, the author or compiler modifies the teaching of Paul and Peter, and arranges or suppresses the incidents of their history in accordance with his purpose. By all critics the four great epistles, viz. Romans, 1 and 2 Corinthians, and Galatians, are accepted as being undoubtedly of Pauline authorship, and it is chiefly by arguments supposed to be based upon these that the authenticity of the Acts and the genuineness of the other epistles ascribed to Paul are called in question. Briefly stated the theory of Baur is to the effect that the books of the New Testament, with the exception of the four epistles mentioned and the Apocalypse, are fictitious productions, belonging to some period

in the second century, based upon certain historic foundations, but chiefly written with the design of reconciling the Petrine and Pauline Christians. It is supposed that during the whole of his life Paul stood apart from the other apostles, by whom his claim to the apostleship was not admitted, and that his conception of Christianity was not only independent, but also widely different from their own. It is to Paul that we must ascribe the origin of Western Christianity, for while the other apostles never saw more in their faith than a reformation of Judaism, with the acceptance of Jesus as the Messiah and a belief in his speedy return, Paul rose to a higher level, and saw in it a religion for all men, a new spiritual influence sent by God for the salvation of the whole world.

In their microscopic investigation of the writings of the New Testament, and their careful and systematic comparison of the doctrines enshrined there, it cannot be denied that Baur and his followers have called attention to many points in connection with them which earlier scholars had overlooked or misunderstood, nor that they have effectually dispelled some of the traditional illusions which have hitherto hidden the early years of Christianity. The importance of the part taken by Paul in the founding of the primitive church is now seen to be much greater than has hitherto been supposed, and looking at the matter merely from the historical point of view, there are some grounds for the opinion that without his labours, Christianity might never have assumed the character of a universal religion at all. But on the other hand, it is equally evident that whether or not the books of the New Testament were written with a tendency, there can be no question as to the tendency—writing of the Tübingen critics. Dazzled by the novelty and charm of their theory, they have pressed it far beyond anything that can be warranted by the facts available, and have endeavoured to support it not only by reasons based upon purely gratuitous assumptions, but also by some which are of necessity mutually destructive. Most of the modern followers of Baur, while approving of his method, admit that he carried both his destructive and constructive theories too far, and that there is room for further consideration of the subject. The majority of English scholars still defend the Pauline authorship of the thirteen epistles, though it is admitted there are difficulties in connection with the pastoral epistles, 1 and 2 Timothy and Titus, which cannot be satisfactorily disposed of in the present state of knowledge.

Whatever may be the final decision of scholarship upon the points in dispute, one result of the controversy which can hardly pass away has been a clearer realization of the high place that must be assigned to the apostle in the history of the human race. By the grandeur and depth of his spiritual conceptions, by the power of his thought applied to the most momentous of problems, by his intense enthusiasm, his courage, stern and resolute endurance, and heroic life of self-sacrifice, he gave an impulse to human thought and conduct, the force of which is even now felt by the whole western world, and which seems likely to increase and expand rather than diminish in the ages yet to come.

The literature that has gathered round the life and writings of the apostle is already of enormous extent, and every year adds to its volume. Among the more important English works published during recent years are "The Life and Epistles of St. Paul" by Conybeare and Howson (1852); "Epistles of St. Paul to the Corinthians," &c., by A. P. Stanley (1855); "The Epistles of St. Paul to the Thessalonians, Galatians, and Romans," by B. Jowett (1855); and "The Life and Work of St. Paul," by F. W. Farrar, D.D. (London, 1882). See also Baur, "Paulus der Apostel Jesu Christi" (Leipzig, 1845); Pfleiderer, "Der Paulinismus" (Leipzig, 1873), both of which have been translated into English and published in the Theological

Translation Fund Library; Renan's "Saint Paul" (1869); K. Schmidt's "Die Apostelgeschichte" (vol. i. Erlangen, 1882); and Sabatier's "L'Apôtre Paul" (second edition, Paris, 1882).

PAUL, ST., a town of the United States, the twin capital with Minneapolis, which it adjoins, of Minnesota, situated on the Mississippi, 410 miles from Chicago, and 791 by river from St. Louis. The valley of the river is terraced; the lower terrace being occupied by the railway, stockyards, and a few stores and warehouses on the north bank. The upper bench, encircled by the bluffs, forms the main business portion of the place to the east and west; the elevation of the bluffs is maintained upon a prairie plateau, which is covered with residences. To the north the land falls rapidly, and upon the lowlands beyond are some extensive railway works and other manufacturing establishments. Still further north and beyond the city limits there is a chain of lakes from which the city is supplied with water. St. Paul is one of the most remarkable among the many remarkable illustrations of rapid growth in the United States. In 1850 it had a population of 1400; in 1885 the number had increased to 100,000. It is the head of the Mississippi navigation and one of the chief railway centres; it has an immense transit trade in grain and lumber. Abundance of good building limestone, found in the vicinity, affords unusual facilities for architectural adornment.

PAUL, FATHER. See SARPI.

PAUL I., Emperor of Russia, son of Peter III. and Catharine II., was born in 1754. He lost his father at an early age, and the death of his brother Ivan, in 1763, made him heir-apparent to the crown. He had good instructors, but was treated with great strictness by his mother as long as she lived, and was studiously kept in ignorance of all public affairs. In 1780 he travelled through Germany, France, and Italy, under the title of Comte du Nord. On his return to Russia he continued to live in retirement until 1796, when, on the death of Catharine, Paul, then forty-two years of age, was proclaimed emperor. His character soon showed itself in all its capriciousness and violence. He liked to interfere in the most minute details of police and of military discipline, which caused much discontent among the soldiers and numerous desertions—a thing almost unknown till then in the Russian army. In the same spirit he remodelled all the departments of administration, and all the courts of the empire, in consequence of which thousands of civil officers were thrown out of employment.

In his foreign politics Paul at first seemed disposed to adopt a system of neutrality in the great quarrel between France and the allied powers. But the invasion of Switzerland, of Rome, Naples, Malta, and Egypt, by the French determined him for war. He sent one army into Italy under Suwarrow, and another into Switzerland under Korsakow. Suwarrow was at first successful, but Korsakow was defeated, and both armies were ultimately withdrawn. Paul withdrew from the coalition and thus offended the allies, but at the same time made no proposals of peace to France. He next quarrelled with England because she refused to give up the island of Malta to him, and Bonaparte bethought himself of profiting by this circumstance to gain his friendship. He accordingly collected all the Russian prisoners in France, clothed them, supplied them with muskets, and sent them back to Russia. This produced its effect; and Paul, who had proclaimed himself the champion of legitimacy, became suddenly a great admirer of Bonaparte.

His next step was to seize the English vessels in his harbours, because England had sent a fleet to Copenhagen in August, 1800, to oblige Denmark to acknowledge the navigation laws and the right of search of neutral vessels. In December of the same year he concluded a convention with Sweden and Denmark, to which Prussia soon after

acceded. In consequence of this step England put an embargo upon the vessels of the Baltic powers.

In February, 1801, Bonaparte secretly concerted with the court of Russia the plan of an expedition to India. Meantime England had sent a fleet into the Baltic, under Parker and Nelson, to dissolve the maritime coalition. Nelson attacked the Danish fleet, 2nd April, and on the 4th an armistice was signed between Denmark and England. While the armistice was being concluded news arrived of the sudden death of Paul, who was strangled by some of his own officers on the night of the 24th of March, 1801, after having refused to sign an act of abdication. The Baltic coalition was thereby dissolved. Paul's son, Alexander I., was proclaimed emperor.

PAUL VERONESE. See PAOLO.

PAULICIANS, the name assumed by a Christian sect which appears to have been founded about 660 by Constantine, an Armenian of Mananalis, near Samosata. Originally a member of some Gnostic sect, he appears to have been led by the study of the Pauline epistles to the belief that they were pervaded by dualistic ideas, and that their true meaning was hidden from the church. Hence he endeavoured to found a society which should form a true Pauline church, and he changed his own name to Paul as a token of veneration for the apostle. He was followed by other teachers who had imbibed his principles, and the new sect increased throughout Asia Minor until it assumed considerable political importance. The Paulicians were treated with much severity by the Byzantine emperors, and the persecution reached a climax under Theodora (841-856), who ordered them to return to orthodoxy under pain of death. To these persecutions they opposed an armed resistance, and many of them emigrated into Saracen territory, where they maintained an independent government. After a time they became powerful enough to ravage some portions of the Byzantine Empire, and in 871 the Emperor Basil, after defeating them, caused them to be removed into the neighbourhood of Philippopolis in Thrace. Here for about two centuries they enjoyed much religious liberty and independence, but becoming troublesome they were crushed by the Emperor Alexios Komnēnos (1081-1118), and from this time they disappear from history as an organized sect. Their peculiar doctrines, however, were preserved by the Euchite monks, and according to some authorities they reappeared in the teaching of more than one sect during the mediæval period. As they left no literature, and we are indebted for our knowledge of their opinions to their opponents, it is not easy to say how far they departed from orthodox Christianity. They appear to have insisted strongly on the Gnostic idea of an opposition between flesh and spirit, to have rejected many of the external observances of religious worship, and to have professed an extraordinary veneration for the apostle Paul. Originally austere in their morals, there is reason to believe that at some periods of their history they gave way to licentiousness.

PAULINUS, to whom the first Christian conversion of Northumbria is due, was one of the missionaries with St. Augustine, first bishop of Canterbury, sent over to him in 601 by Gregory the Great. When the great Eadwine, king of Northumbria up to Eadwinesburgh (Edinburgh) and beyond, married the Kentish princess, Æthelburg, the maiden brought with her to the north the priest Paulinus, whose tall stooping form, aquiline nose, and black hair falling round his thin worn face, still lives for us in the pages of our forefathers. Justus, the successor of Augustine as bishop or archbishop of Canterbury, consecrated Paulinus bishop of the church he was expected to found (625). Eadwine was very fortunate on several occasions, and laid his success to the presence of the bishop at his court; while several of his chief men, including the priests, declared that faithfully as they had served Wotan and the rest of

the Norse Olympians they had been but ill rewarded, and were ready therefore to make experience of a new faith. On these slender grounds Paulinus had to work to found his church, and he soon substituted more enduring reasons for them. Eadwine gave him York as his see, nominated him archbishop (627), and built for him a great minster there of wood, which he dedicated to St. Peter. Before his death Eadwine began to replace this by a stone church, and though he did not live to finish it, his nephew Oswald carried out his good work. Not, however, under Paulinus: for the heathen king Penda of Merca overthrew Eadwine at Heathfield, and for a time was overlord of Northumbria, by which inrush of heathendom Paulinus and the beginnings of the church were swept away. Oswald refounded it with Scottish (Irish) monks from Iona. Paulinus had long before this reached Kent in safety (633), and was at once made Bishop of Rochester, over which church he ruled till his death in 644.

PAULINUS, CAIUS SUETONIUS, general in Britain in the reign of Nero, from 59 to 62 A.D., had earned a considerable reputation by his African campaigns against the Moors in the reign of the Emperor Claudius. He was at first equally successful with our Celtic forefathers; but an atrocious insult inflicted on Boadicea, queen of the Iceni, by some of the officers of Paulinus, set the angry queen at the head of a widespread, deep-seated conspiracy. An expedition of Paulinus to Mona (Anglesey) gave the opportunity, and 70,000 Romans and allies perished. But the experienced general was even then more than a match for his savage opponents, and the revolt did not last long after his return. Boadicea killed herself when all hope of freedom had perished (61 A.D.). Paulinus was honoured with the consulship after his return to Rome; and after the death of Nero he fought for the Emperor Otho against the insurrection of Vitellius (68). Vitellius had the magnanimity to pardon Paulinus.

PAULLUS. See PAULUS.

PAULOWNIA is a genus of the order SCROPHULARIACEÆ. The only species, *Paulownia imperialis*, is a native of Japan, but has been introduced into England. It is a tree of average size, with a spreading head, ovate-cordate leaves, and large purplish-lilac flowers, which are developed early in the year.

PAUL'S CATHEDRAL, ST., in London, is the most prominent building in that huge city, and is the largest Protestant church in the world. According to an old tradition the original Christian church on this site was erected in the second century, and after being destroyed in the persecution under Diocletian, was rebuilt only to be desecrated by the Saxons. A church was certainly founded on this spot by Æthelbert in 610, which lasted until 961, when it was destroyed by fire. The building erected in its place lasted until about 1083, when it was burned, and in its place a much grander structure was raised, which, with many alterations, endured until 1666, when it perished in the Great Fire of London. Old St. Paul's was a noble and imposing building, much larger than the present cathedral, being 690 feet in length, 130 in breadth, and about 150 feet in height, with a stone tower surmounted by a spire, which rose to a height of 520 feet. At one period of its history it was divided into no less than 76 chantry chapels, which employed the services of some 200 priests.

The present building was designed by Sir Christopher Wren, commenced in 1675, first opened for divine worship in 1697, and finished in 1711, at a cost of £747,951, defrayed partly by public subscription and partly by a tax on coals. In criticising the building it must always be borne in mind that the architect was never allowed the free play of his genius, and that he was compelled to give up his original design, and to modify materially that which was accepted in order to meet the wishes of the king, the heir-apparent, the bishops, and the clergy. Under these

circumstances the erection of such a noble building is a wonderful monument to his skill. It is an Anglo-Gothic church of the largest class, except only in the breadth and number of the compartments, built in the form of a Latin cross, with a projection on each side of the western extremity. It is 514 feet in length by 286 in breadth, the height from the pavement of the churchyard to the top of the cross being 370 feet. To the west front, which is designed as the principal entrance, are added laterally beyond the breadth of the building two bell-towers, which rise with pyramidal summits to double the height of the roofs, or 222 feet; and behind or east of them are two oblong chapels, rising no higher than the aisles, but having rooms over them corresponding to the clerestory. The other entrances in the north and south transepts are semicircular, under porticoes with six Corinthian columns. The eastern end is semicircular and plain in style. In the centre, supported by eight arches, rises the dome, which though not the largest, is admitted to be the finest in the world in respect to its graceful outline and imposing effect. The outer dome is made of wood, covered with plates of lead; and the weight of the stone lantern, and the gilt copper ball and cross, by which it is surmounted, is sustained by a cone of brickwork, in the interior of which is built the inner dome, seen from within the cathedral. This inner dome was formerly decorated with paintings relating to the life of St. Paul, by Sir James Thornhill, but these have given place to a series of splendid mosaics, the first of which was fixed in 1884. The choir, which is 165 feet long, has ranged along each side fifteen stalls, the woodwork of which is superbly carved by the celebrated Grinling Gibbons. At the end of the south range is the episcopal throne, the stall of the Bishop of London being in the centre, while just opposite, in the centre of the north range, is placed the stall of the Lord Mayor of London. [See the plan and elevation of St. Paul's in the *PLATES ENGLISH CATHEDRAL ARCHITECTURE*.] The various parts of the building comprise the circular Whispering Gallery, which runs round the base of the dome; the Library, which contains many valuable and interesting works; two galleries outside the dome (from which, under favouring conditions of the atmosphere, fine views may be obtained of the great city and surrounding country); the great clock; and the famous bell, Great Paul. Another object of interest is the geometrical staircase of ninety steps hanging together without visible support. Underneath the nave and chapel lies the Crypt, the burial-place of many heroes and distinguished men. In the centre under the dome is the tomb of Nelson, to the right being placed that of the Marquis of Cornwallis, and on the left that of Collingwood. In the crypt, encaised in a sarcophagus of porphyry, are also the remains of Wellington, his splendid monument being placed in a recess on the right of the nave above. In the vaults lie also the remains of Abercromby, Moore, Howe, Rodney, Picton, and many other celebrated warriors; Howard, Dr. Johnson, Astley Cooper, Sir William Jones, Sir Christopher Wren, and other distinguished civilians, with the painters Reynolds, Barry, Opie, West, Turner, Lawrence, Landseer, &c.

Five services are held daily in the cathedral, the two chief services being at ten in the morning and four in the afternoon. There are four services on Sundays. Many special services, which are very largely attended, are held during the year. The central space under the dome has accommodation for 4000 worshippers, and this is often filled to overflowing by visitors from all parts of the country, drawn by the beauty of the musical services celebrated on special occasions, or by the eloquence and fervour of some of the great Anglican preachers.

PAULUS or **PAULLUS** (230-160 B.C.), a noble family in the great Æmilian gens or clan in ancient Rome. Many Æmilii Pauli are known to the reader of Roman

history, but the most famous Roman of the name was Lucius Æmilius Paulus Macedonicus, so named from his conquest of Macedonia. He was one of the finest of the many grand spirits which form the glory of the great Roman republic. Courageous, capable, proud, incorruptible, simple, magnanimous, unwavering in rectitude, he was beloved by the aristocracy and respected by the people at large. He served all the great offices with stainless reputation, and was twice consul. So devoid was he of any mean ambition, that after brilliant campaigns as prætor in Spain 189 B.C., and as consul in Hither Gaul in 181 B.C. he lived most quietly for no less than thirteen years at Rome, educating his family. In 168 he was named consul a second time, and at once determined to close the war against Perseus, king of Macedonia. So skilful a commander had not much trouble with the ill-trained Greek levies, and at the battle of Pádna, Perseus was completely defeated, and soon afterwards surrendered. Thus ceased the empire founded by Alexander the Great 144 years before. Paulus remained the next year as præconsul, settling with remarkable justice the affairs of the new province. An apparently unprovoked raid on Epeiros is charged by moderns (not by ancients, whose silence approves the deed) against his otherwise unblemished character. From this victory at Pádna the rule of Rome over the civilized world is usually dated. The triumph of Paulus on his return to Rome (167) was the grandest sight the city had till then seen. He brought back the first great prizes of Greek art to the astonished Romans. Paulus served as censor in 164, though he was now at a very advanced age; and he died B.C. 160, leaving so little property that his wife's dowry exhausted the whole. He was honoured with a splendid public funeral, and at the funeral games the first play of Terence was acted. A nobler tribute was the insistence of Spaniards, Gauls, and Greeks, the three nations whom he had conquered, upon their right to bear his body to the pile.

Two of the sons of Paulus are celebrated under other names. One became Quintus Fabius Maximus, adopted by the great opponent of Hannibal, and was the patron of the historian Polybius; and the other grew still more famous as the adopted son of the son of the great Scipio Africanus. He was known as P. Corn. Scipio Æmilianus Africanus Minor, or briefly as SCIPIO AFRICANUS MINOR, and was the victor in the third Punic War, as his grandfather by adoption had been in the first. Paulus had other sons, but one died just before and another just after his triumph, and the old man in his speech to the people on laying down his command referred to this in a simple touching way. "At every success," said he, "I dread the wrath of Nemesis; I thank the gods that this time the blow has fallen upon me alone. No one is left to bear the name of Paulus. But I repine not at this domestic sorrow; I can rejoice that Rome is happy, even while I am miserable."

PAULUS ÆGINETA, the Latin name for Paul of Ægina, a celebrated Greek physician, said to have been born in the island of Ægina at the end of the sixth century. Beyond the fact that he studied at Alexandria, and afterwards travelled through Greece and other countries for the purpose of adding to his medical knowledge, nothing is known about the circumstances of his career. He lives, however, in his great work commonly called "*De Re Medica Libri Septem*," which is at once a compilation of pre-existing knowledge and a record of his own observations. He treats of surgery and midwifery, as well as of medicine, his writings on the obstetric art obtaining for him among the Arabs the title of "the accoucheur." He was also the author of other works which were held in honour by the Arabians, but the book mentioned is the only treatise that has come down to us. It has been translated three times into Latin, the last translation, by Cornarius, appearing at Basel in 1556, and in its Latin form it has passed through numerous

editions. An excellent translation into English, by Dr. Francis Adams, was published in three vols. by the Sydenham Society, at London, in 1846-48.

PAULUS DIACONUS, so called because he was deacon of the Church of Aquileia, was born about 730, at Friuli. He received an excellent education in Pavia, at the court of the Lombard king, Ratchis, became private secretary to Desiderius, king of the Lombards, and tutor to his daughter, Adelperga. For his pupil he wrote his "*Historia Romana*," a compilation enlarging Eutropius, and continuing the history in six books till the fall of the Gothic power. Although a work of no originality, it became very popular during the mediæval period, and numerous MS. copies have been preserved. It has been conjectured that Paulus accompanied Adelperga to the court of her husband, Duke Arichis of Benevento; but however this may be, in 781 he was a monk in the celebrated monastery of Monte Cassino, whence he repaired soon after to the court of Charlemagne, who esteemed him for his learning, and sought his aid in carrying out some educational reforms. By the direction of Charlemagne he compiled his "*Homiliarium*," or a collection from the best sources of homilies suitable for all the Sundays and holidays in the year. About 787 Paulus returned to Monte Cassino, where he continued till his death, which took place 13th April, 797. He was highly esteemed during his lifetime, and was unquestionably one of the most learned men of his age. In addition to the works mentioned he was the author of the "*Historia Langobardorum*," an incomplete history of the Longobards, which breaks off with the death of Luitprand in 744; the "*Gesta Episcoporum Mitisium*," a life of Gregory the Great, some poems, letters, and theological pieces. A critical life of Paulus, by Professor Felix Dahn, was published at Leipzig in 1876.

PAULUS HEINRICH EBERHARD GOTTLÖB, a distinguished German theologian, was born at Leonberg, near Stuttgart, 1st September, 1761. He studied at Tübingen, and afterwards, through the kindness of Baron von Palm, he was enabled to make a tour through Germany, Holland, England, and France, and visit the chief libraries in each country. In 1789 he was appointed professor of Oriental languages at Jena, and on the death of Biederlein, in 1793, he became professor of theology. In 1803 he removed to Würzburg; in 1807 to Bamberg; in 1808 to Nürnberg; and in 1810 to Ansbach. From Ansbach he went in 1811 to Heidelberg as professor of exegesis and church history, where he laboured till his death, which took place 10th August, 1851. He had ceased to fill any public office from 1841, in consequence of old age. Paulus was a man of unwearied industry, and his writings were received with much applause during his own day. He was one of the leaders of the rationalistic school, and in all his studies he started from the idea that everything recorded as miraculous and supernatural in the Bible or in the history of Christianity, was either capable of explanation on natural grounds or to be regarded as fabulous. He lived long enough to see his own rationalistic theory superseded by the "mythical theory" of Strauss, and also to see this disappear before the criticism of the leaders of the Tübingen school. His principal publications are—"Memorabilien" (Leipzig, 1791-96); "*Sammlung der Merkwürdigsten Reisen in den Orient*" (seven vols., Jena, 1792-1803); "*Philologisch-kritischer und Historischer Commentar über das Neue Testament*" (Leipzig, four vols., 1800-4); "*Leben Jesu*" (Heidelberg, two volumes, 1828); and "*Exegetisches Handbuch über die drei ersten Evangelien*" (Heidelberg, three vols., 1830-33). See also Reichenbach's "*Paulus und Seine Zeit*" (two vols., Stuttgart, 1853).

PAUPERISM. See POOR LAWS.

PAUROPUS is a remarkable genus of MYRIPODA, discovered by Sir J. Lubbock, and placed by him in a

distinct order, Pauropoda. Pauropus presents a remarkable resemblance to the spring-tails (Podurida), except in the presence of legs on all the segments. The body consists of eight segments besides the head, the middle segments carrying two pairs of legs, so that nine pairs are present. The antennæ are remarkable, being five-jointed, bifid at the extremity, and bearing three long jointed appendages. There appear to be no organs of respiration, as both tracheæ and stigmata are absent. *Pauropus Huxleyi* is about the twentieth of an inch in length; it is white and active, found in England among dead leaves. The young have three pairs of legs. Sir John Lubbock has described a second but rarer British species, *Pauropus pedunculatus*; and *Pauropus Lubbockii* has been described from the United States.

PAUSANIAS, the author of the description or itinerary of Greece, "*Hellados Periegesis*." Little or nothing is known of him, except what may be collected from his own work. The "*Description of Greece*" consists of ten books: the first contains the description of Attica and Megaris; the second, Corinthia, Sicyon, Phlius, and Argolis; the third, Laconia; the fourth, Messenia; the fifth and sixth, Elis; the seventh, Achaia; the eighth, Arcadia; the ninth, Boeotia; and the tenth, Phokis. Among the latest and best editions is that of Bekker (Berlin, 1826-27). There is an indifferent English translation by Thomas Taylor. Pausanias was more of a religious antiquary than a traveller in the ordinary sense of the word. He minutely describes all the temples, monuments, and sites that he investigates; and he narrates their legends and their history, and probably few books have in consequence become so invaluable as this of Pausanias. It is very accurate and full as far as it goes, the style being somewhat difficult and occasionally obscure. Pausanias wrote in the reign of Marcus Aurelius (161-180 A.D.), and was probably a native of Lydia.

PAUSANIAS, King of Sparta, as he is generally called, was in truth only the regent for his young cousin Pleistarchos. His rule extended from B.C. 479 to 470. His fame began with his command of the contingent of 5000 men sent by Sparta to the Greek army resisting the invasion of Xerxes. After the defeat of the fleet of Xerxes at Salamis and his departure to Asia, Pausanias, who had the honour of the supreme command of the Greeks, about 100,000 strong, completely overthrew at Plataia the 300,000 men of the Persian army under Mardonios, which Xerxes had left behind to complete the conquest of Greece (479). The Greeks munificently awarded him a tenth of the spoils, and begged him to continue the attack on the whole Persian dominions in Europe. A fleet was collected, and Pausanias reconquered Cyprus and Byzantium with it. But believing himself by far the greatest man in Greece, and seeing clearly that under better leaders the Persians would be able to crush Greece, on account of their superior wealth and superior numbers, Pausanias determined to strike a bold blow for the tyranny of all Greece with the help of the Persians, before he was forced to retire into a subordinate position at the majority of his cousin the king. Accordingly, while yet in the full tide of his conquests, he sent secret proposals to Xerxes, that they should join in the conquest of Greece and that he should marry the king's daughter. These proposals, more dangerous to Greek liberty by far than either of the great Persian invasions, were eagerly accepted. Meanwhile suspicions got abroad. The army deposed Pausanias, and elected the Athenian commander its chief. Thus began the supremacy of Athens. Pausanias was summoned to Sparta and tried, but was not condemned. He renewed his intrigues. At last a messenger to the Persian court, having wondered why none of his predecessors ever returned, opened the letter of Pausanias which he bore, and found therein directions for his own death. He showed the letter

to the ephors, the chief magistrates of Sparta, who at once set forth to arrest the regent. Pausanias fled into the sanctuary of Athena. Here he might not be touched: but the roof was stripped off to deprive him of shelter, and the door was built up, his aged mother laying the first stone to immure the traitor. As he was at his last gasp the door was hurriedly opened and his body was dragged forth, that the temple might not be polluted by his death (B.C. 470).

PAUSANIAS was also the name of the murderer of Philip of Macedonia. Some say he did it from revenge for a slight, others as "the shortest way to fame," in a like spirit to that which induced Hérostratos to fire the temple at Ephesos, or Empedoklès to leap into Etna.

PAVAN, a dance-measure and its accompanying song and tune, of Elizabethan age. It was the stately Italian dance of the period, hence called the Padovan or Pavan, from Padova (Padua); the attempt to derive it from *pavo* (Latin, peacock) is a clumsy piece of folk-etymology.

The pavan is best described in Morley's quaint words ("Introduction to Practical Musick"): "A pavan, a kinde of staide musike, ordaind for graine dauncing, and most commonly made of three straines, whereof merie strain is plaid or song twice. A straine they make to contain 8, 12, or 16 semibreves, as they list, yet fewer than 8 I have not seen in any pavan. After every pavan we vsually set a galliard. The Italians make their galliards (which they term Salta-relly) plain, and frame ditties to them which in their mascarades they sing and dance."

It is noteworthy how Morley counts the notes in a strain where we should number the bars, bars in our modern sense being unknown for more than a century later. It is also observable that the galliard was held as the English term for the Saltarello ("Salta-relly"), and that like the later "sarabund and giga," and the still later "minuet and trio," so the pavan and galliard formed a complete movement. By Morley's time singing to the dances was already dying out before the rapid improvement of instrumental proficiency, but it still existed, as the numerous *ballets* show, these ballets being brisk, simply written part-songs, with a well-marked rhythm suitable for dancing to, or else part-songs which were in that style, though perhaps rather too refined for actual use by dancers. Already it was the custom both for instrumental and vocal works to use the old dance measures merely as forms for musical expression. The pavan was thus used, as we see from the title of Douland's "Lachryme, or Seaven Teares, figured in Seaven Passionate Pavans." The pavan when played fast was called a *passa mezzo*. When it is felt that this quickening of the measure destroyed the stately grace of the pavan and substituted for it an unsteady dance, the point of the jest which Shakspeare puts in the mouth of Sir Toby Belch may be better understood:—"He's a rogue, and a passy-measure pavin; I hate a drunken rogue" ("Twelfth Night," v. 1).

PAVEMENT, the name given to the various coverings used to protect the surfaces of roads and streets. The use of pavement dates from a very early period, and the Romans were celebrated for the durability and beauty of their work of this description. [See ASPHALT.] Some portions of the old pavement are still in use in Rome and its neighbourhood, and in the excavations at Pompeii much of the pavement has been laid bare, and is still in good condition. The blocks of stone used by the Romans, though not always of regular shape, were very carefully fitted together, and they were always laid upon a carefully prepared and solid foundation. With the breaking up of the old Roman Empire, the art of paving, like many other arts, fell into disuse, and the mediæval cities were for the most part left unpaved until about the twelfth century, when the main streets began to be protected by stone. The work, however, was of a very inferior character, a number of large rounded

boulders being roughly set together so as to present a rugged, uneven surface to the traffic, marked with many ridges and hollows, in which all kinds of filth accumulated. It was not until a very recent period that pavements of properly squared and dressed blocks of stone began to be generally laid down in the streets of towns, and many experiments were necessary before a thoroughly satisfactory method was discovered. The plan recommended in 1824 by Telford, the engineer, for the best class of road paving, involved the use of blocks of granite, 6 to 7½ inches wide, 10 inches deep, and from 11 to 13 inches in length. These were placed upon a firm foundation of broken stones, and the pavement thus formed was a great improvement on the old style. Since then the plan has been adopted of laying the road with a solid bed of concrete to form the foundation, and covering this with blocks of granite about 3 inches wide by 9 in depth, the stones being bedded in sand or mortar, and grouted with hot lime from the top. A well-made pavement of this description will endure a severe traffic for many years, and it can be readily swept and cleansed from dirt, but of necessity it is somewhat expensive to lay down or renew. Where there is much traffic it is also very noisy, and in some busy thoroughfares this is a serious drawback, and one that has given rise to many attempts to find an efficient substitute. Wood pavement, in which blocks of wood previously steeped in some preservative composition and placed end up, were substituted for granite, was introduced in London in 1811, but it proved only partially successful. It was easily laid, and much quieter than stone, but it wore out very quickly, and in wet weather became very slippery. About 1871 an "improved wood pavement" was introduced under an American patent, which has since come very largely into use. In laying this, after the usual foundation of concrete has been made, boards which have been steeped in tar are laid down, and upon these the wooden blocks, which are about 3½ inches wide, are laid in courses with a space of about half an inch between them. This space is half filled with natural asphalt, and then lime and sand are rammed home until a level surface is obtained. This pavement affords a smooth, easy, and slightly elastic surface for driving, and also a fairly good foothold in wet weather. Two kinds of asphalt have also been largely used for paving of late years. See ASPHALT.

PAVEMENTS, STRIATED, in geology, are layers of boulders, occasionally found in the boulder clay of glaciated regions [see ICE AGE], and were so named by the late Hugh Miller, who observed them in Scotland. They owe their pavement-like appearance to the pressure of once superincumbent ice—whether glaciers or icebergs seems doubtful—and by the same agency they have been considerably scratched and grooved, all the striae being nearly parallel and persistent in direction over the same bed.

PAVIA, a town of Italy, the capital of a province of the same name, is a well-built city of 29,941 inhabitants, stands in an unhealthy situation on the left bank of the Ticino, a few miles above its junction with the Po. A handsome covered bridge over the river connects Pavia with the suburb of Borgo-Ticino, on the right bank. The town is surrounded by walls, and has an old castle. The cathedral, which is a modern structure, was rebuilt in the last century; it is still unfinished, but contains the remains of St. Augustine and some good paintings. The oldest church in Pavia, and perhaps in Italy, is that of San Michele—the Basilica Reale of the House of Savoy—which is asserted by some antiquarians to have been built in the sixth, by others in the eleventh century. Several old and curious basso-relievos adorn this church, as well as some frescoes of the age of Giotto. The vast church Del Carmine, which was erected in the fourteenth century, contains some valuable paintings. That of Santa Maria-Coronata was built

by Bramante, and is also rich in paintings. The once handsome church of San Pietro, "in Cielo d'Oro," noticed by Dante ("Paradiso," x.), has been used as a military storehouse.

Pavia is chiefly known for its university, which was founded by Charlemagne, and has been restored in modern times. Spallanzani and Volta were professors here, and it has long been renowned for its medical and surgical instruction. A valuable library of 50,000 volumes, a museum of natural history, a cabinet of anatomy, and a botanical garden, are annexed to the university. Three colleges, Caccia, Borromeo, and Ghislieri, the first two founded by the noble families of those names, and the third by Pope Pius V., support about 120 students gratuitously. The college Borromeo is a magnificent building. The Marquis of Sanmazzaro some years ago founded an establishment for forming skilful artists near to his splendid palace. Pavia gives title to a bishop; it has a large hospital, a house for foundlings, and numerous other benevolent institutions; a royal gymnasium, a theatre, a chamber of commerce, and a good trade, principally in silk, rice, wine, and Parmesan cheese.

Pavia, called *Ticinum* by the Romans, was a town of Cisalpine Gaul; little mention is made of it in Roman history. Near it Francis I. was defeated and taken prisoner by Charles V. in 1525. It was taken by the Spaniards in 1745, and by the French in 1796. Five miles from Pavia, on the road to Milan, is the *Certosa*, once the most splendid monastery in the world, but now suppressed. It was built by Gian Galeazzo Visconti, duke of Milan. His monument is in the church, which is rich in sculptures, marbles, and fresco paintings.

PAVIA is a genus of plants belonging to the order SAPINDACEÆ. The species are shrubs or trees of moderate size, native of North America, and often cultivated in shrubberies as ornamental plants. The genus differs from *Æsculus*, to which the common horse-chestnut of Britain belongs, by having a smooth capsule. The Red-flowered Horse-chestnut (*Paria rubra*) is a slender tree from 20 to 30 feet high, of which several varieties are cultivated in England. *Paria flava* is larger, and has yellow flowers. Another cultivated species, *Paria discolor*, is a shrub only 5 or 6 feet high, but remarkable for the beauty of its flowers.

PAWN BROKING (Lat. *pannus*, Dutch *paul*, Ger. *pfaund*, a pledge). The business of lending money on pawns or pledges is one of very considerable antiquity, and one that is found in some form in most civilized nations. There are several enactments in the Pentateuch regulating the practice, and the Roman law upon the subject was very comprehensive and elaborate. In England the business appears to have been introduced by certain Italian merchants as early at least as the reign of Richard I. In the reign of Edward I. a message on the site of the Lombard Street of to-day was confirmed to these traders by statute. Originally known as the Longobards, they were termed subsequently Lombardens, and their trade being lucrative they amassed considerable wealth. They appear to have retained a monopoly in pawnbroking until the reign of Elizabeth, but during the reigns of her successors, James I. and Charles I., lending money upon pledges became a recognized portion of the business of the goldsmiths. From time to time statutes have been enacted to regulate the business, and these were consolidated and amended by the 35 & 36 Viet. c. 93.

The operation of this Act—as of all previous ones—is limited to transactions not exceeding £10; above that sum pawner and pawnee are free to deal in any way they like, and on any terms they may agree to. This freedom of contract may also, at the borrower's option, be extended to transactions between £2 and £10, but the statutory rules and rates apply if nothing is said or done to the contrary.

By the Act, pawnbrokers are permitted to charge one halfpenny for the pawn-ticket, and one halfpenny per month for every 2s. or fraction of 2s. advanced upon any pledge up to 10s. After the first month, any time not exceeding fourteen days may be charged as half a month, and any time exceeding fourteen days and not exceeding one month may be charged as one month. The pledge must be redeemed within twelve calendar months and seven days, otherwise it becomes the property of the pawnbroker. For loans above 10s., but not exceeding £2, the rate of interest is the same, but one penny may be charged for the pawn-ticket, and the pledge, if unredeemed within twelve calendar months and seven days, must be sold by public auction under stated regulations. Within three years after sale the pawner or holder of the pawn-ticket may inspect the account of the sale in the pawnbroker's books on payment of one penny, and the pawnbroker must on demand pay the surplus, if any, produced by the sale to the holder of the pawn-ticket. But the pawnbroker is allowed to set off the deficiency on sale of one pledge against surplus on another of the same pawner. Where the loan exceeds £2 and is under £10, and no special contract is made, the rate of interest allowed is one halfpenny per month or part of a month for each 2s. 6d. advanced. The conditions as to redeeming the pledge, selling by auction, and claim to surplus, are the same as in loans above 10s. and not exceeding £2. The holder of a pawn-ticket is presumed to be the person entitled to redeem the pledge, and the ticket must be delivered when redemption is required, but provision is made in the Act for cases in which the pawn-ticket is lost or destroyed. In such cases the pawner may apply to the pawnbroker for a printed form of declaration to be made before a magistrate, which, on being duly sworn and delivered to the pawnbroker, will reserve to the pawner the same rights and remedies as if he produced the pawn-ticket. A pawnbroker must insure all pledges to the extent of 25 per cent. above the amount advanced upon them, in addition to his ordinary liability for their full value if damaged by negligence while in his custody.

Any person desiring to commence business as a pawnbroker must make application for permission to a metropolitan police magistrate, sitting in the district where the application is made, or of a stipendiary magistrate where such have jurisdiction, and of justices of petty sessions specially convened for that purpose in other places; twenty-one days notice of the application must be given to one of the overseers of the poor of the parish in which he intends to carry on business, and to the superintendent of police of the district, and a like notice must be affixed to the church door twenty-eight days before the application. Having obtained the necessary magisterial certificate, a license may be obtained of the Commissioners of Inland Revenue. A separate license must be taken out for each shop, and the duty is £7 10s. per annum. Conviction of fraud or of knowingly receiving stolen goods may, if the court thinks fit, be punished by forfeiture of license.

The statute does not extend to Ireland, where the law permits a much higher rate of interest than is chargeable in England upon those "small pawns" which form the staple of the pawnbroker's business in a poor country; but with certain modifications as to procedure, Scotland is included in its provisions.

PAXTON, SIR JOSEPH, a distinguished English horticulturist and architect, was born at Milton-Bryant, near Woburn, Bedfordshire, in 1803. After being educated at the Woburn Free School, he entered the service of the Duke of Devonshire at Chiswick, and evincing talents of no ordinary kind, was in due time promoted to the post of chief gardener at Chatsworth. He now wrote several works on his favourite science, and established and edited, with conspicuous success, a magazine of botany.

The noble glass conservatories at Chatsworth were designed by him; and his experience in the management of iron and glass induced him to submit a plan for the erection of a suitable building for the reception of the Great Exhibition of 1851. The edifice, when completed, was so novel in character and so effective in appearance as to secure general admiration. Its architect received the honour of knighthood, and was afterwards employed to construct the more ambitious and infinitely more splendid Crystal Palace of Sydenham. In 1854 Sir Joseph was elected member for Coventry, which he continued to represent, to the satisfaction of his constituents, until his death, 8th June, 1865. A handsome memorial cross was erected in commemoration of him in that town in 1869.

PAYMASTER, in the army and navy, is a commissioned officer ranking, according to length of service, with lieutenants, captains, or majors. The pay of the chief paymasters in the army is 30s. per day, of staff paymasters 22s. 6d. to 25s., and of paymasters from 15s. to 20s. In the navy the pay varies from £255 10s. to £602 5s. per annum, according to length of service. The duty, as the name signifies, is to manage the finances of the regiment or ship.

A *paymaster-sergeant* is a non-commissioned officer who acts as clerk to the paymaster, and receives from 2s. to 3s. 6d. per diem, according to the regiment and length of service. In the navy the paymasters were formerly called pursers, and were paid by profits on the ship's charges. They are now provided for in the estimates, and their duties and pay are similar to those of the army. They have, however, the additional care of the provisions, clothing, and stores of the ship, as well as of the money.

PAYMASTER-GENERAL is the name given to the officer of the British government whose duty it is to superintend the payment of all money voted by Parliament. He is constituted by warrant under the sign-manual, and must be a member of one of the Houses of Parliament. The office is not a permanent one, but is held by a supporter of the ministry in power. The salary is £2000 a year, the assistant paymaster-general receiving £1300, and the deputy paymaster for Ireland £1200. The annual cost of the department is about £26,000. The London office adjoins the Treasury in Whitehall, and the Irish office is at the Castle, Dublin.

PAZZI, CONSPIRACY OF THE. See MEDICI.

PEA (*Pisum*) is a genus of plants belonging to the order LEGUMINOSÆ and tribe PAPILIONACEÆ. The Garden Pea (*Pisum sativum*) is a climbing annual with compound pinnate leaves, the petiole of which terminates in a branching tendril; at the base of the leaf is a pair of large stipules. The flower-stalks are axillary, with two or more white or pale violet flowers of the irregular form, known as papilionaceous, common to the tribe. The stamens are ten, nine being united by their filaments, while the uppermost is free. The ovary is one-celled, terminated by a long, bent, triangular style, compressed from side to side at the tip, and fringed with hairs on its inner edge. The fruit is a legume or pod containing several stalked globular seeds, the *peas*. The garden pea has not been found wild, and may be a cultivated variety of the Field Pea (*Pisum arvense*). The garden pea has been cultivated from the greatest antiquity. Peas have been found in the Swiss lake-dwellings of the bronze age, and perhaps of the stone age; they closely resemble the seeds of the garden pea, but are smaller. The garden pea is said to have been introduced into England about the time of Henry VIII. by way of Holland or France. The Field Pea (*Pisum arvense*) occurs wild in Italy, even in forests and mountainous districts. Its cultivation does not seem so ancient as that of the garden pea. The field pea is distinguished by having a solitary red flower on each flower-stalk, from two to four leaflets on each leaf, and the seeds compressed and mottled.

Peas are cultivated as food nearly all over the world,

and a great number of varieties have been established, differing chiefly in the characters of the pods and seeds. In the sugar-peas the pod has not the usual parchment-like inner lining, but is tender and succulent, and is eaten whole, like French beans. The seeds differ greatly in size and colour, and in the number contained in one pod. In colour every tint is found between almost pure white, brown, yellow, and bright green, while in the sugar-peas the seeds are red, purple, or dark chocolate, and the pod is often purple. The wrinkled or marrow peas have a wrinkled surface; they are large and flattened at the sides through compression in the pods. The most famous variety of these is the Champion of England.

Peas are valuable, not only for the seed, which is used as food, but also as fodder. The seeds are highly nutritious, both in the green and ripe state. When green they are used as a vegetable; when ripe they are dried and split, and used for soups or ground into meal for making a kind of bread. The high nutritious value of the pea as an article of food, and its convenience as being easily kept good for a long time and quickly prepared when required, has led of late years to its extensive use by travellers, and in one famous instance by soldiers. In the form of the "pea-sausage" (*Urbeverst*) of the German army it provided the invading force of 1870 with readily portable and convertible food unknown to their French opponents. The "pea-sausage" could always be depended upon when no meal was to be had, and was an efficient auxiliary when meat was short; it kept good for any reasonable length of time, and might be eaten raw if no opportunity served for cooking it, or if cooked it might be made very palatable in half a dozen different ways. Little cakes of pea-meal, mixed with a proportion of fat of some kind, are found very valuable on similar accounts by travellers.

The best soil for peas is a strong clayey loam with abundant vegetable manure. The times for sowing are, in November for the earliest crop, and at intervals of a month, three weeks, or a fortnight, as the season advances, till midsummer. The produce from any that may be sown after this period is very uncertain, as is indeed the case with the November and other sowings previous to those of spring. The shelter afforded the young plants in winter by spruce branches or temporary awnings is of course beneficial. The distance which should be allotted for the intervals between the rows of peas may be 3, 4, 5, or 6 feet, according to the growth of the sort and richness of the soil. The plants should not be allowed to grow too thick in the rows, otherwise they are drawn up slender, without a due proportion of foliage on the lower part of the stem, which, in that case, as well as the leaves depending on it, becomes unhealthy and apt to mildew. The dwarf kinds need no stakes as support. Peas are also cultivated as a field crop. The haulm makes excellent fodder, more nutritious than hay.

The Pea Weevil (*Bruchus pisi*) is very destructive to crops of peas. It lays its eggs on the young pod, and the grub, when hatched, eats its way through the pod into the pea and feeds upon its substance, but, as it does not attack the embryo, infested peas are capable of germination, but never produce productive plants.

The genus *Lathyrus*, which contains many species known as peas, is only distinguished from *Pisum* by the style, which is not thick nor triangular, but compressed from above downwards. Several species are cultivated. The Sweet Pea (*Lathyrus odoratus*), a native of Southern Sicily, is a favourite in gardens for the beauty and fragrance of its flowers. *Lathyrus latifolius* (the everlasting pea), distinguished by its perennial root-stock and large showy but scentless flowers, is also cultivated in gardens. *Lathyrus sativus* is cultivated in Southern Europe for its edible seed and also for fodder. *Lathyrus tuberosus* is found in cornfields in Essex, and in several parts of Europe. On the Continent its tuberous roots are eaten like potatoes.

The Chick Pea is *Cicer arietinum*, a native of India and Southern Europe; it is cultivated especially in the East and in Mexico and South America, where the seed is ground into meal and made into cakes or used for soup.

PEA CRAB (*Pinnotheres*) is a genus of CRABS of small size, remarkable for their habit of living within the valves of the shell of lamellibranchiate molluscs. One species (*Pinnotheres veterum*) is found in the Mediterranean living within the shell of the Pinna, with which, according to the ancients, it contracted a close friendship, warning it in particular against the approach of the cuttlefish. Another species (*Pinnotheres pisum*) is very abundant on the Irish coast in cockles and mussels. The pea crabs are also found in the pearl mussel and in holothurians. Their connection with their host is rather one of commensalism than of parasitism; that is, they do not feed on their host's tissues, but merely appropriate to their own use a portion of his food.

PEA BODY, GEORGE, one of the most distinguished philanthropists of modern times, was born at Danvers (now Peabody), Massachusetts, 18th February, 1795. He was a descendant from an old yeoman family of Hertfordshire, some members of which some six generations before had emigrated to New England. After a limited education at the district school, he became, at the age of eleven, apprentice at a grocery store at Danvers, where he remained four years. He afterwards joined his brother David, who kept a dry goods shop at Newburyport, and when his brother's shop was destroyed by fire, he spent two years with his uncle, who had a business in George Town, Columbia. In 1812 he became partner with a Mr. Elisha Riggs in a dry goods store, Peabody transacting and managing the business, for which Riggs found the capital. In 1815 the house was removed to Baltimore; seven years later its extended operations were such as to justify the opening of branches at Philadelphia and New York; and about the year 1830, by the retirement of Riggs, Peabody found himself the senior partner and the virtual director of one of the largest mercantile concerns in the world. In 1837 he established himself in London as a merchant and banker, and in 1848 he withdrew from the business in America. In his new capacities his assistance was frequently sought by the government of the United States, and in 1848 he contributed largely to restore the credit of Maryland. It is, however, as a wise and generous philanthropist that he is chiefly known to fame, and unlike some who wait for their death to redistribute the riches they can no longer enjoy, he gave his best gifts during his lifetime, and while he was able to watch the results. In 1852 he contributed largely to the arctic expedition fitted out under Dr. Kane, and the same year he founded an educational institute in his native town with 20,000 dollars, afterwards increasing the total endowment to 200,000 dollars. He also gave the sum of £100,000 to found and endow an institution for science at Baltimore, a sum afterwards increased by a second gift of like amount; and among many other gifts he presented 150,000 dollars to Harvard University to establish a museum and professorship of American archaeology and ethnology, while he was known to have given at least 2,000,000 dollars to the American Southern Educational Fund. He retired from business in 1862, and in the March of that year he presented £150,000 to the city of London for the purpose of erecting suitable dwellings for the poor. In 1869 he gave a further donation of £100,000 to the same object, and by his will bequeathed a further sum of £250,000, making in all the magnificent sum of £500,000. The management of this splendid gift has given rise to much adverse criticism, but this does not in any way detract from the kindly wisdom which prompted it. It is impossible within the limits of this notice to enumerate his various benefactions, but the sum total cannot be estimated at less than £2,000,000. In 1867 the United States Congress passed a vote of

thanks to him for his princely donations to the public institutions of America, and he received from Queen Victoria the offer of a baronetcy, which he declined. The queen then presented him with her portrait, and the corporation of London conferred on him the freedom of the city, and erected a bronze statue of him facing the Royal Exchange, which was unveiled, 23rd July, 1869, by the Prince of Wales. He died at his London residence, 4th November, 1869, and after a funeral service in Westminster Abbey, his remains were conveyed by an English man-of-war to America, and buried in his native town.

PEACE, ARTICLES OF THE, in English law, are certain complaints made on oath to a court that the applicant goes in fear of his life or of bodily harm from the threats of another person, and the redress given is to bind the threatening party over with sureties to keep the peace. Such a complaint may be made to any magistrate or justice of the peace, and if satisfied that the complaint is well founded, it is his duty to issue a warrant to bring the offending party before him, who is then heard in his own defence. If his explanation proves unsatisfactory he may be ordered to find sureties, and to give his bond to keep the peace for a period not exceeding a year, and failing to do this he may be committed to prison. If after he has entered into recognizances—that is, given a bond with sureties—he breaks the peace, the goods of the sureties can be seized to pay the amount of the bond.

PEACE, OFFENCES AGAINST THE PUBLIC, are such as actually break the public peace, or such as tend to induce others to break it. A breach of the public peace of slight extent is regarded as a misdemeanour, but if of a serious character it becomes a felony. Sending a challenge, either by word or letter, to a person to fight a duel, is a misdemeanour punishable with fine or imprisonment or both. No provocation, however great, can be pleaded as a justification for sending a challenge, though it may be taken into consideration in the passing of the sentence; and to knowingly bear such a challenge is to be guilty of a misdemeanour. It is also a misdemeanour to challenge another to fight with the fists or otherwise. Prize-fighting is prohibited by law, and if during a prize fight death ensues to one of the combatants it is manslaughter not only in the person who kills, but also in the seconds and in all those who by their presence have encouraged the contest. The fighting of persons in a public place to the terror of her Majesty's subjects is legally termed an affray, and all persons present who encourage such a fight are guilty of a misdemeanour. A riot is the assembling of three or more persons accompanied with circumstances of actual force or violence, or of an apparent tendency thereto, calculated to inspire people with terror. The riotous assembling of twelve persons or more to the disturbance of the peace is a misdemeanour; and if they do not disperse within one hour after the reading of the proclamation in the Riot Act, by a justice of the peace, sheriff, or undersheriff, or mayor, the offence is felony punishable severely. To disobey the orders of the magistrate, or oppose by force the reading of the proclamation, is also felony, and the offenders become liable to a heavy punishment. Also if any of the mob demolish or begin to demolish, or burn any church, chapel, meeting-house, dwelling-house, or other building, or any machinery in any factory or mine, such persons will be guilty of felony and may be sentenced to penal servitude. It is primarily the duty of the magistrates and the police to suppress all riots, but the law expects all good citizens to render their aid, and all private persons may without waiting for the sanction of a magistrate use their best efforts to suppress a riot. In practice, however, in the majority of cases it is best for private citizens to act under the direction of the magistrates or of the officers of the police. A magistrate has power in cases of emergency to call for the aid of special constables to assist

in keeping the peace, or he may invoke the assistance of the military. When any riot or tumult happens, or is expected to happen, justices may order every person licensed to sell intoxicating liquors in or near the place to close his premises during any time such justices may order. Riding or going armed with dangerous weapons, practising secretly military drill without legal sanction, the publication of libels, sending threatening letters, and making forcible entry into houses, all come under the term of breaches of the peace, and are punishable by fine or imprisonment, or in some cases by imprisonment without the option of a fine.

PEACH (*Prunus persica*) is a well-known fruit tree belonging to the order ROSACEÆ, and included by Bentham and Hooker, together with the almond, apricot, plum, and cherry, in the genus *Prunus*. The peach is a tree of medium size, with a spreading head, with long stalked lanceolate stipulate leaves. The flowers appear before the leaves, and have the same general structure as the rose; the ovary contains two ovules, only one of which usually develops into a seed. The fruit is a drupe, the hard stone being formed from the inner layers of the carpel, while the outer layers, consolidated with the calyx-tube, become succulent and fleshy. According as the fleshy part is readily separable from the stone or not, peaches are divided into two varieties, freestones and clingstones. The nectarine differs from the peach only in having a smooth fruit instead of a downy or velvety one, and is a mere variety produced by bud-variation or by seed. Not only do peach-stones produce nectarine trees, and nectarine stones peach trees, but the same tree sometimes bears both peaches and nectarines, or fruits which share the appearance and flavour of both.

The origin of the peach has not been satisfactorily determined, two such authorities as De Candolle and Darwin differing on the subject. Its specific name, *Persica*, points to the belief that it was introduced from Persia. It is nowhere found wild at the present time, except as an escape from cultivation in various parts of Asia. De Candolle considers the peach to be of Chinese origin, having been cultivated in that country from the remotest antiquity. Darwin, on the other hand ("Variations of Animals and Plants under Domestication"), regards the peach as a modified almond, as the two have been cross-fertilized and produced fruit intermediate in character. A French intermediate form, the peach-almond, when grafted on a peach, bore for two years almonds and the third year peaches.

The peach is greatly cultivated for the sake of its fruit, and has given rise to many varieties. The trees come into bearing very quickly, in some cases the second year after planting. In Britain the peach is generally trained on walls, and usually in hot-houses; but in North America, where the cultivation is most extensive, it is a standard tree. Light is very essential. Extremes of dryness and moisture must be avoided. The roots should be well supplied with water before the fruit begins to ripen off, because at a later period none can be applied without deteriorating the flavour.

This plant is propagated almost exclusively by budding; but occasionally splice-grafting is adopted. The peach stock is rarely used, but frequently the almond, especially in France. In this country, however, it is propagated almost entirely on the plum stock, which is not only much harder, but also possesses the property of spreading its roots nearer the surface than either of the two preceding kinds, thereby affording to the tree a more congenial nourishment in consequence of the roots being within the influence of the solar heat.

The peach succeeds in any rich fresh loamy soil; but the subsoil, like that for all fruit trees, ought not to be retentive, and a very complete mode of drainage is absolutely necessary. The surface of the border should be frequently stirred; and when the weather is dry, watering will be

necessary both for the border and foliage; but the use of cold spring water must be avoided. The ravages of the green fly must be carefully guarded against. The best known remedy is to dust the tree, after syringing, with snuff or powdered tobacco leaves.

Thinning the fruit is generally done much too sparingly. The vigour of the tree should of course be taken into consideration. As a general rule, one fruit on each bearing shoot, or two at most, are all that ought to be left. Some remove the flower-buds to a considerable extent, a practice which is very proper. It is advisable, however, to preserve several on each shoot, in order that a choice may be made of one or two of those likely to take the lead.

In North America a spirituous liquor, peach brandy, is made from the inferior fruit. The preserving of peaches in cans for export is largely carried on in the United States. The seed or kernel contains prussic acid like that of the bitter almond. The peach is liable to the attacks of a fungus and several insects, the most formidable of which is the peach borer, the larva of a clear-wing moth (*Ageria exiliosa*), which bores into and feeds upon the wood.

PEACOCK or PEA-FOWL (*Pavo*) is a genus of game birds (GALLINÆ) belonging to the pheasant family, Phasianidæ. The peacock is remarkable for its large size and splendid plumage, its peculiarly shaped crest, and the length of its tail-coverts, which form a superb train, capable of erection into a large and brilliant disc, supported by the true tail. The tail owes most of its gorgeousness to the loose silky barbs of its feathers, which terminate in eye-like spots. The neck, back, wings, and tail are all adorned with gleaming colours—green, black, brown, violet, and gold—which render the bird an object of universal admiration. The crown of the head is surmounted by a tuft of feathers with slender shafts, each terminated by a small brilliant palette. The female bird is smaller, with a sombre brown plumage and no train.

The peacock, the proverbial emblem of vanity, is a native of India. It was early known to the Greeks, as their ascription of it as the favourite bird of Hērā shows; it is also mentioned by Aristophanes, but probably Alexander the Great first made it familiar in Europe. The peacock is kept now in small numbers for ornament. It is only semi-domesticated, roosting on trees, &c., and being neglectful of eggs and young. It is not very prolific.

In the wild state the peacock frequents the jungles and forests, and feeds upon fruits, seeds, and insects. It possesses considerable powers of flight, and generally roosts in high trees. The females deposit their eggs on a little grass placed on the ground among bushes. The voice of the peacock is exceedingly harsh and discordant, its cry being imitated by its names in various languages.

Pied or white varieties of the peacock are sometimes seen. The Japanned or black-shouldered peacock, which by some is considered a distinct species, is regarded by Darwin as a strongly marked variety. The cock is smaller than the ordinary peacock, and has the upper wing-coverts a deep lustrous blue instead of being mottled with brown and white; the hen and the young birds are whitish. This variety breeds true, but frequently appears quite suddenly among a stock of the ordinary pea fowl. The second species of peacock, *Pavo muticus*, a native of Burma, Sumatra, and Java, has similar but less brilliant plumage. The neck and breast are greenish, with golden reflections, and the feathers of the crest are webbed along their whole length.

In antiquity the peacock was sacred to Hērā and her Latin counterpart Juno, probably from its royal appearance. It is always represented in funeral Roman bas-reliefs as bearing the empresses up to heaven, in like manner as the emperors are borne aloft by eagles. Hence

in Christian archæology the peacock is often used as a symbol of the resurrection.

The Latins, at the close of the commonwealth, began to use roast peacock as an article of food. The orator Hortensius has the credit of first introducing the dish, importing the bird from Sannos. No banquet of any importance was held complete without the royal bird. Along with the pheasant it was bred in aviaries for the table; and not only the bird itself, but its eggs were highly esteemed. As the mania for extravagant expenditure increased, dishes of peacock's brains and peacock's tongues were invented merely as a means of making dishes costly. In mediæval times peacock was still a very usual dish at great festivals, and the custom was to cook the bird and afterwards to surround it with the skin bearing the plumage. It is often seen thus being borne into the great hall in state, in old illuminations and paintings, along with the swan, its competitor for favour. The peacock's plumage (but not its flesh) is seen on our tables now, as a beautiful decoration, forming an ornamental cover to a game-pie. The flesh of the peacock is occasionally still served and is very palatable, its flavour being intermediate between that of the ordinary chicken and the pheasant. The eggs of pea-fowl are also relished.

PEACOCK ORE, a variety of copper pyrites with a brilliant variegated surface. See CHALCOPYRITE and COPPER.

PEAR (*Pyrus communis*) is a well-known fruit tree occurring wild over the whole of temperate Europe and Western Asia. It belongs to the same genus as the APPLE, and is a member of the order ROSACEÆ. In the wild state it is either a large shrub or small tree with thorny branches. The flowers are pure white, with purple anthers. The fruit tapers towards the stem, the base of which is not sunk, as in the apple, in a cavity; in the tissue of the fruit are concretions of indurated cells, constituting the "grit," which are never found in the apple. Under cultivation the pear-tree increases considerably in size, and loses its thorns. The cultivated fruit is greatly improved in size and flavour, but the characteristic shape is often lost, some pears having quite the shape of apples. Like the apple the pear is a spurious fruit, the fleshy part being formed by the calyx-tube, which becomes greatly dilated, inclosing the core composed of the five cartilaginous carpels, which are the true fruit. The pear has been cultivated from a very early date. Pears, together with apples, are found in the Swiss lake-dwellings; they are mentioned by Homer, and a number of varieties were under cultivation in the time of Pliny. Their cultivation in Britain was probably due to the Romans. The so-called wild pears of Britain may be only escapes from cultivation which have reverted to the original form.

The pear is chiefly propagated by grafting or budding on the wild pear stock, or on stocks raised from the seeds of cultivated pears, called free stocks. The former are, however, to be preferred. It is also grafted on the quince, which is most proper for dwarf trees, or for moist soil, and has also the effect of bringing the trees earlier into a bearing state. It may be grown upon the meallar and the white thorn (*Crataegus oxyacantha*), but on these the disparity of growth between the respective stems occasions a short duration of the union.

The pear-tree will thrive in any rich loamy soil; but it is only where the subsoil is naturally congenial, or rendered so artificially, that it will continue to produce good crops of well-flavoured fruit. A clay subsoil is bad, and so is, in fact, any other that will hold water. Good drainage is absolutely necessary, and shallow planting cannot be too much recommended. Maturity is not so liable to prove injurious to the pear and apple as it is to stone fruits. On the contrary, if judiciously applied, it will always prove beneficial.

The modes of training the tree are various. Against walls, the three principal methods are the fan-shape, its reverse, the pendulous, and intermediately the horizontal, which is that most generally adopted. In the fan method the central part of the tree, from the upright position of the branches, or their near approach to such, is apt to become too strong. On the contrary, the pendulous training induces debility when the trees begin to bear heavy crops. By annually cutting back a central shoot to about a foot, and training branches horizontally, right and left, the vigour of the tree is equally distributed. In the cultivation of pears as standards, the head is allowed to take nearly its natural course, being only subjected to such regulations, by pruning, as are necessary to preserve the equality of the principal branches with regard both to strength and distance; and likewise to render the whole sufficiently thin, in order that the sun's rays may be freely admitted. The pruning of standard pear-trees is usually confined to the winter regulation of the branches by thinning, and shortening where the subdivision of branches is desirable, or where they are too weak. Wall and espalier trees require both a summer and winter pruning. In summer a number of shoots are produced beyond those which are required for training. If these are allowed to grow without interruption during a considerable part of the season, and then at once cleared away, the tree is apt to be very much injured.

A very agreeable fermented liquor called *perry* is made from pears, in the same manner as cider from apples. The wood of the pear-tree is very hard and fine-grained, and when dyed black is used as a substitute for ebony.

Another species, the Snow Pear (*Pyrus nivalis*), may have given rise to some of the cultivated varieties. It is distinguished by the white down which covers the under surface of the leaves, and is cultivated in Austria, north of Italy, and some parts of France, in the latter being used in the manufacture of perry.

The Chinese Pear (*Pyrus sinensis*) is wild in Mongolia and Manchuria, and cultivated in China and Japan; it has been recently introduced into Europe. The fruit is fit only for preserving. *Pyrus cordata*, with small apple-like fruit, is found wild in Western France, and in Devonshire and Cornwall.

PEAR, PRICKLY. See PRICKLY PEAR.

PEARL OYSTER (*Meleagrina margaritifera*) is a lamellibranchiate mollusc, belonging to the family Aviculide, and so but distantly related to the edible oyster, which belongs to the family Ostreide. The finest pearls are obtained from this species. It occurs on coasts of tropical countries at considerable depths, and is brought to the surface by divers. The pearl oyster also affords the substance known as mother-of-pearl. A species of pea-crab (Pinnotheres) is often found in the pearl oyster, and probably contributes to the formation of the pearls. The shell is very oblique, and its valves are unequal; it is attached by a byssus, and closed by two adductor muscles. A foot is present. The pearl oyster is inedible. Pearls are also obtained from the Pearl Mussel (*Unio margariferus*), which inhabits fresh waters in Britain and parts of Europe; other species of *Unio*, or the allied species *Anodonta*, yield pearls in America and other parts of the world. These river pearls are generally very inferior to those yielded by the pearl oyster.

PEARL-SPAR is the crystallized variety of DOLOMITE, i.e. a double carbonate of lime and magnesia. It often occurs in fissures in limestones and dolomites, and the rhombohedron is its usual crystalline form: the faces exhibit a pearly lustre, and are noticeable on account of being more or less bent. The mineral is often coloured with iron, the darker kinds being then known as *brown-spar*, and manganese and cobalt also give it an occasional tinge of pink. Before the discovery of a natural mag-

nesium sulphate in enormous quantities at Stassfurth (Prussian Saxony), pearl-spar was largely employed in the manufacture of EPSOM SALTS, and hence received the name of *bitter-spar*: the mineral was treated with sulphuric acid, and the resulting calcium sulphate was readily separated from the corresponding salt of magnesium by taking advantage of its much greater insolubility.

PEARL-STONE or **PEE-LITE**, a kind of glassy lava, having a lustre somewhat resembling that of mother-of-pearl. On examination of thin sections under the microscope, it is found to be traversed by a number of curved concentric cracks, dividing up the rock into an aggregation of very minute spheroids. The structure has been produced by contraction on cooling of the mass, and the pearly lustre of the rock is probably due to the effect upon reflected light of the innumerable microscopical cracks.

PEAR-SALL, ROBERT LUCAS, a composer, who was called by his family after his death "*de Pearsall*," and is generally now known by that name, was, unfortunately for music, not obliged to work hard at his art, and consequently missed that high position to which he undoubtedly would otherwise have attained. It is not too much to say that Pearsall is the only man of our century who could write madrigals like the Elizabethans. His part songs, "*The hardy Norseman*," and "*Oh, who will o'er the downs so free?*" are universally known and popular; but it is works of such supreme beauty as "*Lay a garland*" (eight voices), "*Sir Patrick Spens*" (ten voices), "*Light of my Soul, arise*," &c., which really give Pearsall his unique position. He was born at Clifton in 1795, and at first practised at the bar, but eventually devoted himself to poetry, music, and archaeological studies in England, and also abroad, especially at Mainz and at Carlsruhe, where he resided for some time. It was only in 1836 that he chanced to hear some madrigals well sung in London, and was fired by them to write in that delightful style. Altogether we have about fifty works of the kind from his pen. His essay on the madrigal is a clever performance. In 1837 he bought the Castle of Wartensee, on the shores of Constance, and lived there till his death in 1856. He left much church music behind him, but little of it has been published.

PEAR-SON, JOHN, Bishop of Chester, a learned English theologian, was born at the rectory of Snoring, Norfolk, on the 28th of February, 1612. Educated at Eton, he proceeded on the foundation to King's College, Cambridge. He took holy orders in 1639, and was collated to the prebend of Nether-Avon in the church of Sarum. In 1640 he became chaplain to the Lord-keeper Finch, who presented him to the living of Torrington in Suffolk. But the chief scene of his labours as a parochial minister was in London, where in 1650 he became rector of St. Clement's, Eastcheap. After the Restoration he was created D.D. by royal mandate, installed prebendary of Ely, archdeacon of Surrey, and made master of Jesus College, Cambridge. In 1662 he was promoted to the mastership of Trinity College, Cambridge, and in 1672 he succeeded Wilkins in the bishopric of Chester. He died at Chester on the 16th of July, 1686.

Bishop Pearson's great work is his "*Exposition of the Apostles' Creed*," published in 1659. It is still regarded as a standard theological work, and is constantly reprinted for the use of students. Executed on a formal plan, the words of each article being explained and its assertion defended, the treatise is at once apologetic, polemical, and practical, and the writer makes an admirable use of his great patristic knowledge, as he enters into the history and defence of the several doctrines. Among his other writings are the "*Golden Remains of the ever-memorable Mr. John Hales of Eton*" (1659); "*Vindicia Epistolarum S. Ignatii*" (1672); and "*Annales Cyprianici*," published at Oxford with Bishop Fell's edition of Cyprian's Works in

1682. His "*Opera Posthuma Chronologica*" were edited by Dodwell in 1688, and in 1844 Edward Churton edited "*The Minor Works of J. Pearson*, in two volumes, with a *Life prefixed*," the edition being published at Oxford.

PEASANT WAR is the name given to an insurrection of German peasants in 1525. It was in a great degree caused by the Reformation, which had upset men's minds by its principles of freedom. The insurrection began at Kempten, where the peasantry plundered the convent and made the abbot sign a renunciation of all its rights. This was followed by a general rising of the people throughout the whole of the south of Germany. An army was raised by the emperor, and many skirmishes fought, success alternating with defeat on both sides. The insurrection spread over the entire country, and many convents and castles were destroyed. The peasants demanded the abolition of serfdom, the free election of the clergy, the appropriation of the tithes to the support of the poor, and the abolition of numerous exactions of the ecclesiastical and secular lords. After the war had lasted six months the people were defeated and treated with great cruelty. They were murdered in cold blood, hanged, and tortured to death. More than 150,000 persons lost their lives during or in consequence of this war. The insurgents instead of gaining their freedom fell into a worse state than before, and were more tyrannically oppressed by the nobility and clergy.

Other famous peasant insurrections are those of the *BAGAUDE*, suppressed by Maximian in 287 A.D., and those of the French peasants in the middle ages, called *JACQUERIES*; these are elsewhere described under their respective articles. The Servile War of the ancient Roman republic was not fairly to be called a peasant war, since the soldiers were chiefly gladiators and slaves.

The Peasant Revolt is the title often given to the formidable insurrection in Richard II.'s time (1381), produced originally by the severe tyranny exercised over the free peasants of the country (who, for instance, were forbidden by Statutes of Labourers to leave their own parish, and hence were at the mercy of the landlords), and immediately by the imposition of a poll-tax, i.e. every man throughout the kingdom was levied upon for a stated sum, the same for rich and poor alike. This monstrous injustice brought the long-growing discontent to a head. The tillers of the soil in all Norfolk, Suffolk, Cambridge, and Hertfordshire rose in arms, and in the south the revolt extended from Surrey and Sussex as far as Winchester and Somerset. It was, however, neither of these groups, but the men of Kent only, who actually began a civil war. Under the leadership of Wat the Tyler, a soldier who had served in the French wars, they mustered on Blackheath, to threaten London, 100,000 strong. The firmness of the young king dispelled the danger. Had the peasants held firm, a few days would have multiplied their forces tenfold, and England would have lain at their feet. But Richard, worthless as he proved to be, had the fearlessness and the astuteness of all the Plantagenets. Riding out to meet the peasant army at Mile-End, he advanced alone, crying "I am your king and lord, my good people—what will ye?" "We will that you free—for ever—us and our lands, and that we be never named nor held for serfs." "I grant it," at once replied Richard, and bade them all go home with promises of charters of full pardon. All but 30,000 then went back to their fields, these remaining to watch over the king's execution of his pledge. A quarrel, perhaps purposely provoked, gave William Walworth, mayor of London (whose name is perpetuated in a southern district of the great town), the opportunity to kill Wat Tyler at Smithfield in a somewhat treacherous fashion. Richard again prevented a serious outbreak by declaring himself on the side of the peasants, and he issued the pardons and charters promised. This induced the peasants

to retire. But all over the districts named troubles long continued, gradually dying down, or being put down ruthlessly by the great nobles and landlords. The king himself raised 40,000 men, and marched through Kent and Essex, spreading terror by his vengeance on the insurgents who had foolishly relied upon his word. At Billericay they fought two whole days in the woods. England has never been so near a communistic state as she was in those days of 1381.

PEAT is an accumulation of decaying vegetable matter, occurring in moist situations in temperate climates; the less compact varieties are also known under the name of *turf*. The areas occupied by it are usually too swampy for cultivation, unless first drained by artificial means, and are commonly spoken of as *peat bogs* or *peat mosses*; when thickly covered with heather, and occurring in hilly regions, they are also termed *moors*; and when layers of peat alternate with alluvial deposits, and the various parts of a district are alternately occupied by bogs and mud flats—as in the east of England—the area is known as a *fen*. The spongy vegetable mass itself consists chiefly of the remains of mosses, grasses, sedges, equisetums, heaths, and other marsh-growing plants, and varies considerably in appearance according to age and the circumstances under which it has been formed. Sometimes it appears to be nothing but a tangle of fibrous rootlets and slender stems; occasionally the accumulation is more or less consolidated, having a firm texture, and perhaps paper-like (papyraceous); at other times it is almost fluid, and consists of fine precipitated particles; and in some cases it may be mixed with a large amount of earthy matter, graduating into loam. Scattered through the whole are frequent trunks of forest trees and stems of smaller shrubs, associated with fruits and cones; and of these the well-known bog-oak is especially valued as a wood for ornamental purposes.

The peat bogs of the hills are rarely more than 3 or 4 feet in thickness, and are not necessarily confined to hollows or plateaus, but often occur on slight declivities wherever there is any deficiency of drainage. In the low land, however, where the bogs attain their greatest dimensions, they are sometimes met with of considerable depth, and a deposit of 40 feet or more has not unfrequently been noted. In these situations the peat is largely increased in volume by the contained water, a given mass of the peaty matter being stated, under certain conditions, to owe as much as half its bulk to the absorbed moisture. Sometimes, indeed, a peat bog takes up so much water that it assumes a dome-shaped surface, with the rising in the middle, and there often results an overflow of black vegetable mud. This is known as the "bursting" of a bog, and, as a typical example, we may quote Sir Charles Lyell's account of an inundation of this character caused by the great Solway Moss, on the borders of Scotland and England, in 1772. On the 16th of December, this moss, "having been filled like a great sponge with water during heavy rains, swelled to an unusual height above the surrounding country, and then burst. The turfy covering seemed for a time to act like the skin of a bladder, retaining the fluid within, till it forced a passage for itself, when a stream of black half-consolidated mud began at first to creep over the plain, resembling in the rate of its progress an ordinary lava current. No lives were lost, but the deluge totally overwhelmed some cottages, and covered 400 acres. The highest parts of the original moss subsided to the depth of about 25 feet; and the height of the moss, on the lowest parts of the country which it invaded, was at least 15 feet."

With regard to the origin of peaty deposits, it is obvious, from what precedes, that the existence of a lake or any other body of water is not essential for their formation. It is true that many—if not the majority—of low-lying

bogs are simply filled up lakes; but it is equally certain that a large number occupy the sites of overthrown forests, while those on mountain sides are altogether growths upon marshy ground. In the northern hemisphere the main mass of the accumulation is formed by mosses of the genera *Sphagnum* and *Hypnum*, these filling up with their delicate stems all interspaces between the debris of the other plants, and being particularly adapted for this purpose from their mode of growth. While the lower portions of these mosses are dead and decaying, each long winding fibre is tipped by a short green stalk in full vigour of growth, and is thus continually lengthened. *Sphagnum*, *Hypnum*, and their allies are capable of existing wherever the ground is marshy, so that the stoppage of drainage produced by the destruction of a forest is quite sufficient to insure their presence; it has been stated, indeed, that several English bogs have been entirely formed within historical times, and occupy the sites of forests felled by Roman invaders. "We are also told that the overthrow of a forest by a storm, about the middle of the seventeenth century, gave rise to a peat moss near Lochbroom, in Ross-shire, and that, in less than half a century after the fall of the trees, the inhabitants dug peat there. But the rate at which peat is known to form in places where its growth has been carefully noted by scientific observers, is so slow that it is necessary to receive these accounts with caution" (Lyell).

To the student of the latest geological period peat bogs are of great interest, as entombing numerous relics of man's handiwork and the bones of animals that have been mired in the treacherous ground. And those that mark the sites of ancient forests are also of importance, from the information they afford regarding the recent changes of climatal conditions that any particular district has undergone. In Denmark, for example, the lowermost layers of peat contain numerous trunks of the Scotch fir (*Pinus sylvestris*); higher up there is evidence of forests of the common oak (*Quercus robur*); later still a variety of the common oak, the alder, birch, and hazel flourished there; and quite lately the common beech (*Fagus sylvatica*) has almost supplanted them all.

As already remarked, deposits of peat are exclusively confined to temperate latitudes, although there are occasional traces of it in some of the larger swampy forests of the tropics; under the latter circumstances, however, decomposition takes place too rapidly to allow of any considerable accumulation. Even so far from the equator as the southern parts of France and Spain bogs are comparatively rare, and they not only become more abundant in colder climates, but the peat is also more inflammable. Ireland is particularly remarkable for its peat bogs, and it is said that no less than one-tenth of its surface is covered with them; one on the Shannon is 40 miles in length and varies from 2 to 3 miles in breadth. On the southern side of the equator a similar distribution is to be observed. Until 45° S. lat. is reached, peat is practically absent, but there are extensive bogs in the Falkland Isles, Tierra del Fuego, and other neighbouring lands; and Mr. Darwin has pointed out the interesting fact that this South American peat is not formed by mosses, but mainly by various higher plants, chief among which is a sedge-like lilaceous plant, *Astelia pumila*.

From a chemical point of view, peat is intermediate between recent vegetable matter and brown-coal or lignite, but its value as a fuel, when air-dry, is much deteriorated by the large proportion of water which it retains, ranging, as it does, from 20 to 30 per cent. When freshly cut from the bog it contains 80 to 90 per cent. of water. Much ingenuity has been expended on pressing and drying machines to remove this excess of moisture, but with no economical success. The amount of peat obtainable is so large and the bogs so extensive, that it has long been a favourite subject of experiment, and much money and labour have been spent on it. The specific gravity of peat varies greatly; light

spongy brown peat is sometimes as low as 0.25, the dense black peat will rise as high as 1.25. The former is somewhat extensively used as litter for stabling purposes, and is said to be a much better absorbent than straw, and to form a more valuable manure. The latter, when employed as a fuel, as compared with ordinary coal, requires three times the quantity by weight and much more in bulk, and this greatly increases the cost of carriage and of firing. It has been employed, however, in smelting the purer forms of iron, and makes a very pure cast iron free from sulphur. There is also this peculiarity about peat, that where a large supply is required the cost increases with the quantity collected, because a larger area must be worked. No economical method of overcoming this difficulty has yet been effectual, though many have been proposed and worked. One of the most feasible yet suggested is to cut canals through the bog and put steam dredgers on them to lift and carry the peat. It has been largely distilled for PARAFFIN and ammonia and for making peat charcoal, but in this country the working has been entirely abandoned.

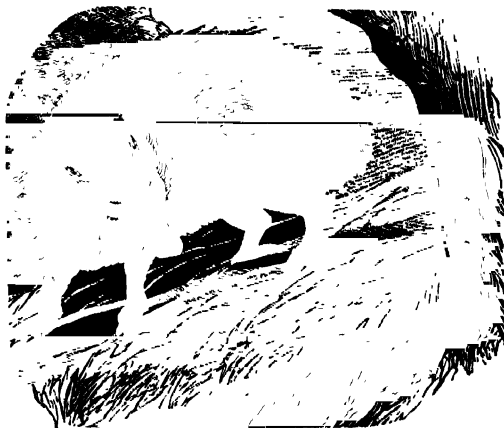
The following analyses show the composition of peat from various localities. The composition of the ash varies considerably:—

	Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Ash.
Bog of Allen, . .	61.02	5.77	32.40	0.81	7.90
Hebrides, . . .	60.00	6.90	30.00	1.30	1.90
Devonshire, . .	51.02	5.21	28.17	2.30	9.73
France,	46.11	5.99	35.97	2.63	9.40
Holland,	50.85	4.65	29.20	1.05	14.25
Germany, . . .	57.20	5.32	36.00	1.56	2.31

PEBIDIAN ROCKS, the uppermost division of the archæan strata of Britain, so named by Dr. Henry Hicks, F.R.S., from Pebidian, a district near St. David's, Pembrokeshire, where they are typically developed. No fossils have yet been discovered in them, and they consist mainly of compact grits, quartzite, porcellanitic and other altered shales, associated with abundant igneous rocks. With the other archæan rocks, these beds were originally classed by the Geological Survey as intrusive greenstones and metamorphosed Cambrian (or Silurian) strata. Besides those of the typical locality, Pebidian rocks have also been detected in North Wales, Anglesey, Shropshire, and Ireland; and the remarkable series of old deposits in Charnwood Forest, Leicestershire, are also possibly referable to the same age. The latter strata comprise a large number of altered volcanic tuffs and agglomerates, and certain of the shaly beds are worked for roofing slates.

PEC'ARY (*Dicotyles*) is a genus of South American ungulates, belonging to the family Suidæ, being the only surviving representative in America of the group Omnivora, which comprises the pig (*Suidæ*) and hippopotamus family (*Hippopotamidæ*). The peccary differs from the pig in several respects, notably in the character of the middle (third and fourth) metacarpal and metatarsal bones, which are separate in the latter, but are united in a common bone, as in cattle, in the former. The peccary lacks the outer toe of the hind foot, which is present in the pigs. The number of teeth is also less, the upper incisors being reduced to four, and the anterior premaxillary in both jaws being absent. The canines of the upper jaw form short lance-shaped tusks, having their points directed downwards, and being entirely concealed within the lips. The lower canines are also large, directed upwards and outwards. The peccary is small, being about 3 feet in length. The body is covered with thick bristly hair, which is long on the neck, forming a kind of mane. The tail is a mere tubercle. Near the tail is a peculiar gland which secretes a substance emitting a musky odour; when the peccary is killed for food it is necessary to cut out this gland immediately, or the whole of the flesh will be tainted. Two species are known. The Common Collared Peccary or

Tajacu (*Dicotyles torquatus*) ranges from Texas to the Straits of Patagonia. It is gregarious, frequenting forests. It is omnivorous, feeding on roots, fruits, reptiles, worms, &c.; and often does much damage to cereal crops. The common peccary is of dark gray colour, with a narrow white band surrounding the neck. The White-lipped Peccary (*Dicotyles labiatus*) is rather larger, being about 40 inches in length, and is confined to South America. It agrees generally in its habits with the common species,



The Collared Peccary (*Dicotyles torquatus*).

but is far more ferocious, and inflicts most dangerous wounds with its sharp tusks. It is of a darker colour, with the lips and lower jaw white. The flesh is similar, but inferior to that of the domestic pig.

PE'COCK, REGINALD, was the author of the most important prose work written during the reign of Henry VI. Peacock was a Welshman, born about 1400, and admitted to priest's orders in 1421. He became, ten years later, master of Whittington College; and residing in London, he actively engaged in attempting to convert the Lollards, the Puritans of the fifteenth century. A dialogue called "Donet," a sort of catechism setting forth the main dogmas of the church, was written by him in this regard in 1440. He was made Bishop of St. Asaph's in 1444, and still continued his reasonings with the Lollards as vigorously as before. In 1449 he finished his great book, the "Repressor of overmuch Blaming of the Clergy," which gained him promotion to the see of Chichester. But the good bishop, who was sincerely in earnest, had come between two fires. The Lollards were not to be reasoned from their faith on the one side, and on the other the clergy, whom Peacock had so strenuously defended, found upon consideration that in his fairness he had laid open to controversy much that should in their view have been dogmatically held. The clergy felt that argument was not their strong point, they preferred an unquestioning faith, and they looked with insuperable jealousy upon religious discussions in the vulgar tongue. When Peacock boldly proposed to rest his whole case upon a reasonable interpretation of Scripture they were alarmed, and when finally it was discovered that he had said in one place that the clergy would stand condemned at the last day if by clear wit they draw not men into consent of true faith otherwise than by fire, sword, and hangedment, they determined to disavow him. His appearance in a council at Westminster was the signal for the disappearance of the other lords. A council of examiners was appointed, and Peacock was declared a sickly sheep. He saved himself

from burning by giving up his books to the hangman's fire. According to one of his own principles he was compelled, no doubt with inward bitterness, to bow to the decision of the church. He was deposed from his see, and locked up in Thorney Abbey, in Cambridgeshire, in a room where he had a distant sight of an altar and no other books than his Bible and Breviary, nor were pens and paper within his reach. His "Repressor" is a fine specimen of an early form of our prose speech, and is among the greatest treasures of our literature.

PECTEN, is a genus of molluscs belonging to the order LAMELLIBRANCHIATA, and the type of the family Pectinidae. The shell is nearly circular in shape, with one valve much more convex than the other. It is provided with two angular projections, called *ears*, which widen the sides of the hinge. Some of the species swim with considerable speed by flapping their valves together, while others attach themselves by a byssus. The foot is small. The pectens are among the most brilliantly coloured of the inhabitants of the sea, the body being often bright orange or scarlet, and the shell adorned with various brilliant hues. The majority of the species of this genus are tropical, but several species are found on British coasts. The Great Edible Scallop (*Pecten maximus*), found on many parts of our coasts, is almost as much esteemed as the oyster, but requires cooking. The shell is large, 6 inches long and 5 broad; the flatter valve is reddish, the convex valve white and adorned with ribs. The body is pinkish, the gills being orange. The large species found in the Mediterranean, the *Pecten Jacobaeus*, is the scallop or pilgrim's shell, worn in front of the hat by those who had visited the shrine of St. James at Compostella.

"In his black mantle he was clad,
With Peter's keys, in cloth of red,
On his broad shoulders wrought;
The scallop-shell his cap did deck."—*Scott*.

PECTIN is the substance forming the jelly of fruits. The pulp of fresh unripe fruits and of fleshy roots contains a substance called pectose. This substance is insoluble in water, but when heated it is acted on by the acids of the fruit and converted into pectin, which is soluble, and forms a jelly on cooling. The firm consistence of fruit jellies is due to this substance. The formula is $C_{22}H_{48}O_{32}$. It is a white amorphous neutral mass, soluble in water, and precipitated from solution by alcohol. Boiling with dilute acids converts it into two isomeric modifications, parapectin and metapectin. In contact with alkalies all three substances are converted into pectic acid ($C_{16}H_{22}O_{15}$), which possesses feeble acid properties, and is insoluble in water. Long boiling with caustic alkalies converts it further into metapectic acid ($C_{24}H_{32}O_{22}$), which does not gelatinize. The metallic pectates and metapectates are not crystallizable, but mostly gelatinous bodies of variable composition, rendering the exact formula of the acid somewhat doubtful. Bodies of the pectin group or pectous substances are largely distributed in the vegetable kingdom.

PECULIUM was that property which, by the favour of his master, to whom all his earnings by law belonged, a slave could acquire in ancient Rome. It was even permitted by the more generous nobles that a slave should purchase his liberty with his peculium as soon as it reached a certain agreed amount. The origin of the peculium was probably the fact that the slaves managed nearly all business affairs, and made nearly all manufactures, &c., among the Romans; so that a greedy master, who allowed no peculium, was robbed right and left by his angry slaves. Our word "peculiar" comes from this term.

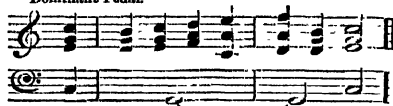
PED'AL. In musical instruments pedals are of various kinds:—(1) Those keys which are acted on by the feet of the performer; (2) the levers acting on the swell of the organ, and on certain groups of stops (combination pedals); (3) those of the pianoforte, the left-hand one of which

raises the dampers when it is depressed, so that the strings continue to sound until the pedal is set free, while the right-hand one either shifts the action, or part of it, so that only two strings out of three are struck by the hammer, or else reduces the blow of the hammer, or else causes a soft felt to interpose between the hammer and the strings, in either of the three cases softening or weakening the power of tone. Sometimes more than one of these varieties of soft pedals are used in a pianoforte; and sometimes other attachments are worked by pedals, varying with the ingenuity of the manufacturer; but the above are the essential pedals. (4) The pedals of the harp act upon the strings, pinching them so as to shorten them and raise their pitch by one semitone, or by two semitones, as required; each pedal sharpening all the notes of one name (as all the F's, all the C's, &c.), and thus, when suitably combined, enabling the harp to play in any key desired.

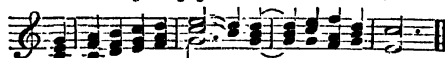
PED'AL BASS (or *Pedale*, or *Organ-pedal*, or *Point d'Orgue*), in music, is a bass which remains stationary on one note, while the other parts continue moving and forming various chords, all of which must be strictly confined to the key, no modulation whatever being allowed; chromatic passing notes, however, are freely permitted. Only the tonic and the dominant are allowed to be taken as pedals in any key. The rules governing pedals are (1) that the lowest part of the moving harmony shall form a good bass whenever the chord is one in which the pedal note itself is not an essential note; (2) that the pedal can only be quitted when it is an essential portion of the harmony; though a pedal may begin against a chord in which it has no part; (3) a pedal may, though it must not modulate within itself, close with a modulating chord, and so pass out of its key; this modulating chord being upon the last note only.

When a similar construction is followed in an upper part it is called an *inverted pedal*, and is allowed the same freedom as an ordinary pedal. A few examples follow, chiefly from Macfarren.

Dominant Pedal.

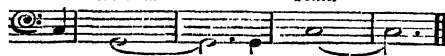


Pedals beginning against chords not their own.



Dominant.

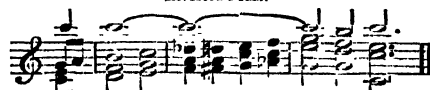
Tonic.



Pedal closing with a modulation.



Inverted Pedal.



There are two sorts of double pedals; one when the bass-pedal is doubled by an inverted pedal, as in the illustration; and another when both tonic and dominant are used as pedals at once, as in the opening to Beethoven's "Pastoral Symphony," and as with the double drone of the bagpipes, &c.

If two pedal passages, one dominant and the other tonic, occur together, the tonic must always come last: in fact a tonic pedal (except as a drone) is not often used save at the close of a piece. The almost invariable close of a good fugue is a long dominant pedal (the most important, though often not the only, dominant pedal in the fugue) followed by a shorter tonic pedal.

PEDALINEÆ is an order of plants belonging to the group *GAMOPETALÆ*. It contains herbaceous plants with simple exstipulate leaves, opposite or alternate, and axillary irregular flowers, solitary or clustered. The calyx is split into five almost equal lobes; the corolla is gamopetalous and hypogynous, with the limb bilabiate; the stamens are five, inserted on the corolla-tube, one being rudimentary and the rest united in pairs; the ovary is one-celled with parietal placentas, surrounded at the base by a glandular disc. The fruit is generally capsular, with wingless exalbuminous seeds. This is a small order, nearly allied to the *Bignoniaceæ*, containing about forty species, chiefly tropical, occurring especially in Africa. From the seeds of species of *Sesamum* abundance of oil resembling olive oil is obtained.

PEDESTAL, the base or block on which statues, columns, &c., are placed. In form it is like a column, having a base (or foot), shaft (or dado), and capital (or cornice).

PEDIGREE. A pedigree is a tabular view of the members of any particular family, with the relations in which they stand to each other; together, usually, with some slight notice of the principal events of the life of each, as the time and place of birth, marriage, death, and burial, the residence, the profession, or rank of the principal person named in it, and public offices held by him. Sometimes these are accompanied by reference to evidence of the fact stated, as to inquisitions, parish registers, monumental inscriptions, marriage settlements, and deeds of all kinds. But when there is much of this kind of information and evidence introduced, the writing is rather called a genealogy or genealogical history than a pedigree.

Tabular genealogies, or pedigrees properly so called, are not of very frequent occurrence in the writings of the middle ages. But at about the beginning of the sixteenth century, when the College of Heralds began to pay more attention to the genealogy of the English families in reference to their claims to dignities and to the distinction which the right to armorial insignia gives, many pedigrees were compiled; and in the course of that century the heralds obtained copies of all such accounts of the English families of any distinction as could be supplied to them, and made such accounts matter of public record by entering them in the books which contain the record of their official proceedings. The pedigrees thus collected are in the visitation books at the College of Arms, and form a vast body of this species of information, highly important to those who are studying critically the biography of the distinguished persons of the English nation.

Besides this grand collection of pedigrees, there are many similar collections made by private persons, or by the heralds themselves in their private capacity. There are several of these in the library of the Heralds' College, some are in the British Museum, and others in the hands of private persons.

Since the visitations were discontinued, there has been no official and regular collection of pedigrees. But there has been a continual addition made to the pedigrees which are on record in the visitation books by the entry in the

books of the Heralds' College of their pedigree by particular families. In some cases, as of peers, this is compulsory.

When arms are granted or dignities conferred, it has been usual for families to record in the college what they know of their descent and alliances. The books are open to any private person, who may, at a moderate expense, enter a pedigree showing the existing state of his or her family, and whatever is within the recollection of the older members of it, or can be proved by sufficient evidence. The entries thus officially made are matters of record, and contain information which is often very interesting to the posterity of the persons who occur in them, and may be of importance in protecting rights which belong to them.

PEDIMENT, in architecture, the low triangular space, identical with the gable of a roof, over the front of a building, portico, window, or door. It is frequently enriched with sculpture, and the extreme middle height usually averages two-ninths of the entire width. The etymology of the word is perfectly obscure. It would seem as if it came from the Latin *pes*, *pedis*, a foot, but no connection of meaning is discoverable.

PEDLER or **PEDDLER**. The legal sense of hawker is an itinerant trader who goes about from place to place carrying with him and selling goods; and a pedler is only a hawker in small wares. In the various Acts of Parliament which impose duties upon them and regulate their dealings, they are always named in conjunction as hawkers and pedlars, and by the Pedlers' Acts of 1871 (34 & 35 Vict. c. 96) and 1881 (44 & 45 Vict. c. 45) the term "pedler" is defined as including any hawker, pedler, petty chapman, tinker, caster of metals, mender of chairs, or other person who, without any horse or other beast bearing or drawing burden, travels and trades on foot and goes from town to town or to other men's houses, carrying to sell or exposing for sale any goods, wares, or merchandise, or procuring orders for goods, wares, or merchandise immediately to be delivered, or selling or offering for sale his skill in handicraft. All such persons are required, under penalty of a fine, to obtain a certificate from the chief officer of the police in the place where they reside, and no person can obtain such a certificate unless the officer is satisfied that the applicant is above seventeen years of age, is of good character, and in good faith intends to carry on the trade of a pedler. The fee for this certificate is 5s. and it remains in force for one year; while in force it authorizes the person to whom it is granted to act as a pedler within any part of the United Kingdom. A register of the certificates granted is kept at the police office of each district. A pedler is required to show his certificate to any justice of the peace or police officer, to any person to whom he offers his goods for sale, or to any person in whose private grounds or premises he may be found, and to allow a copy thereof to be taken. A pedler who refuses to show his certificate when it is lawfully demanded renders himself liable to apprehension and to a fine of 5s.

Police officers are also authorized to open and inspect any pack, box, bag, &c., in which a pedler carries his merchandise, and a refusal to allow this renders the pedler liable to a fine not exceeding 20s.

PEDOMETER (Lat. *pes*, *pedis*, the foot; *metrum*, a measure), an instrument for measuring the distance travelled by a man in walking. It is usually in the form of a watch, and its movement is regulated by the motion of the body, so that the index or hand advances one division for every mile or fixed number of yards advanced.

PEDRO, DOM, first Emperor of Brazil and King of Portugal, the son of John VI., king of Portugal, was born at the Castle of Queluz, 12th October, 1798. At the general peace of 1815 he was contracted in marriage with Maria Leopoldina, archduchess of Austria. At that period the colony of Brazil was raised to the rank of a kingdom, and when, in 1820, John VI. was recalled to

Portugal by the Cortes, Dom Pedro remained as regent in that country. When the Cortes of Portugal first began to invade the privileges of Brazil, Dom Pedro placed himself at the head of the popular opposition. Civil war was the consequence, and Dom Pedro was declared protector and perpetual defender of Brazil; and, finally, its independence being declared, was proclaimed emperor, 12th of October, 1822. To various causes of discontent another was added by the death of John VI. in March, 1826, and the consequent succession of Dom Pedro to the crown of Portugal. This event excited fears lest Brazil should again become reduced to the position of a dependency of Portugal. These fears, however, he endeavoured to dispel by abdicating the crown of Portugal in favour of his daughter Donna Maria da Gloria, reserving to himself the regency, with the title of king, during her minority. The succeeding years of his reign were marked by continual disturbances of a political nature. In 1830 the French revolution gave a new impulse to the democratic party, and an affray which took place 6th April, 1831, determined Dom Pedro to abdicate in favour of his son, to whom, being under age, he appointed a guardian, and the following day he left the country. The throne of Portugal, which Dom Pedro had resigned in favour of Donna Maria, had been usurped by his brother Dom Miguel, whom in 1827 he had nominated regent of the kingdom. A civil war ensued, which terminated 26th May, 1832, when Dom Miguel was reduced to the necessity of signing a convention, which left the young queen in quiet possession of the throne of Portugal, under the regency of Dom Pedro. The acts of his short administration should have secured for him the good-will of the more liberal party in his dominions. He strengthened the external relations of Portugal by a close alliance with England and France, and he confiscated for the use of the state the property of the numerous monastic establishments in his kingdom. The anathemas of the Vatican were the natural result of these sweeping measures, and they were soon followed by his own excommunication. In September, 1832, the declining state of his health compelled him to resign the regency, and his daughter was placed in full possession of the royal authority. He died 24th September, 1834.

PEEBLES or TWEEDDALE, a county of Scotland, bounded N. by Edinburghshire, S. by the shires of Selkirk and Dumfriesshire, E. by those of Selkirk and Edinburgh, and W. by Lanarkshire. Its greatest length from N. to S. is 30 miles, and greatest width from E. to W. rather less than 22 miles. The area is 856 square miles. The population in 1881 was 13,822, of whom 7196 were females.

Surface and Rivers.—The general elevation of Peebles exceeds that of any other county in the south of Scotland. The surface consists chiefly of smooth green hills of clay slates, suitable for sheep pasture, and rising towards the south-west, where Broadlaw, at the head of the Tweed and Annan, is 2754 feet high; Hartfell reaches an elevation of 2600 feet, Culter Fell 2454 feet, and Dunrich 2433 feet. There is much moor and bog, but the valleys are well wooded. Peat is abundant, and used for fuel. The soil, elsewhere heavy and barren, is fertile along the Tweed and the small rivers which run between the hills. Estates and farms are large. The best methods of culture are readily adopted. Sheep farming is, however, the chief pursuit. The stock kept are principally Cheviots, with a few of the black-faced breed. Large numbers of these, with cattle, are reared for annual exportation to England. Some coal is raised in the north-west of the county, and a few manufactures of woollens are carried on. Old red sandstone is found on the north border, and a little blue slate and lime are also quarried.

The Tweed, the only river of the county, takes its rise from a spring in the upper part of the parish of Tweedsmuir, situated 1500 feet above the sea-level, and upon the same hill from whose base issue the rivers Clyde and

Annan. Its course within the county is N.E. by N., until it reaches the town of Peebles, after which it is nearly due E., crossing the counties of Selkirk and Roxburgh; and after separating Berwickshire from Northumberland, it falls into the German Ocean about half a mile below the town of Berwick, and about 100 miles from its source. In the first 20 miles it descends through a height of 1000 feet. The numerous rivulets which intersect the county are all tributaries of the Tweed. The chief of these are the Lyne, which rises in the Pentland Hills, and gives its name to the town and parish of Linton; the Peebles or Eddlestone, which falls into the Tweed at the town of Peebles; the Leithen; the Manner; and the Quair, which last falls into the Tweed near the seat of the Earl of Traquair. From the hilly character of the country through which they flow these rivers are subject to sudden inundations, which sometimes occasion considerable injury to the adjoining lands. Most of the streams, and particularly the Manner, contain, during the season, both salmon and trout. Eddlestone Loch is a small lake in the north-east part of the county, from which the South Esk takes its rise. It abounds with pike, perch, and eels, and is the resort of large flocks of wild fowl during summer. The climate is keen, but less severe than that of Edinburgh. The fogs so often met with in the Lothians seldom extend into this county.

The county is divided into sixteen parishes, and is traversed by the North British and Caledonian Railways. It formerly returned a member to the House of Commons, but by the Scotch Reform Act of 1868 it was united with Selkirkshire, and the two counties now have only one member between them, no alteration having been made by the Redistribution of Seats Act of 1885.

Peebles was the seat of the Gadeni, in the Roman province of Valentia, and camps are still to be seen at Lyne and Linton, on Watling Street. The only antiquities are the ruins of numerous castles, "peels," or towers, erected on the banks of the Tweed and its tributaries to oppose the inroads of the English.

PEEBLES (surmised to be derived from Celtic *puball*, a tent), the capital of the above county, is situated in a valley on the north bank of the Tweed, at the confluence of the Eddlestone Water with that river. It is 20 miles due S. from Edinburgh (with which it is connected by railway), 47 E. by S. from Glasgow, and 386 from London. It became at an early period the summer residence and place of rural amusement of the Scottish kings, and particularly of Alexander III. David II., in 1367, created it a royal burgh. In virtue of this title, it returned a member to Parliament, in union with the burghs of Lanark, Linlithgow, and Selkirk, down to the passing of the Reform Act, when its elective franchise was merged in that of the county. The town was exclusively situated to the westward of the Eddlestone till 1545, when, having been burnt by the English, a new town was commenced on the opposite bank, whose houses are unusually substantial. A provost, two bailies, dean of guild, treasurer, and seven councillors, constitute the town council. The Eddlestone Water is crossed by several bridges, and the Tweed by an iron railway bridge, and a stone bridge of five arches, supposed to date from the fifteenth century. The parish church being remarkably ugly, it was determined in 1884 to pull it down and replace it. There are also a Free Church, two U.P. churches, an Episcopal, and a Roman Catholic church. Of St. Andrew's Cathedral only a small portion is now standing. The town contains a grammar-school, now under the school-board, which has a high reputation and is well attended, a corn exchange, hydropathic establishment, town and county halls, and water-works. There is also an excellent library and museum at the Chambers' Institution, founded by Dr. W. Chambers, a native of the town, with reading rooms and a lecture hall. The building

is the most handsome in the town—having been formerly a mansion belonging to the earls of March and afterwards to the Duke of Queensberry. In its quadrangle is the old town cross. The number of inhabitants in the royal burgh is 2609; of the town and police burgh, 3495. The town has some manufactures of woollens. Attracted by the salubrity of its climate and the Tweed fishings, Peebles is a favourite place of summer resort, and many fine villas have been erected in its vicinity since the railway was opened.

PEEL (in Manx, *Purt-ny-Hinsey*, i.e., the harbour of the island or the holme which adjoins it), formerly called Holland, Holene, and Holme Town, is situated at the mouth of the river Nebb, on the west coast of the Isle of Man, its harbour being sheltered by the little island of St. Patrick, on which was built the Castle of Peel, together with St. Germain's Cathedral, and other buildings, now in ruins. Peel has established and Methodist churches, and grammar and naval schools. It is the chief resort of the herring fishery fleet of the island. Indeed this fishery forms the chief support of the inhabitants. There is a net manufactory, and also a shipbuilding yard. The population is 3,500.

The small crypt of the cathedral is like a vaulted dungeon, and was, in fact, used as a prison, not only by the ecclesiastical authorities, but likewise by the governors of the Isle of Man. Thomas, earl of Warwick, was confined here in 1397 for rebellion against King Richard II., and in 1446, Eleanor Cobham, duchess of Gloucester, wife to Duke Humphrey, who was uncle of King Henry VI., and Lord Protector during the minority of his nephew. Besides St. Germain's Cathedral, Peel contains an Irish round tower and the remains of an extremely ancient chapel, said to have been erected here by St. Patrick himself in the fifth century. The castle was built, apparently, in the early part of the fifteenth century, and was finished by Thomas Stanley, first earl of Derby, in the reign of Henry VII. An embattled wall, 4 feet thick, with several towers, incloses nearly the whole space of the islet; but it cannot have been a place of great strength, as it is commanded by the neighbouring hill. Sir Walter Scott's romantic story, "Peveril of the Peak," has made this place interesting to many readers of fiction.

PEEL, SIR ROBERT, the first baronet, was born 25th April, 1750, at Peel's Cross, near Lancaster, a small property belonging to his father, Mr. Robert Peel, whose third son he was. The family, though not wealthy, appears to have been of some respectability for several generations. The subject of this notice was brought up to the cotton trade, and in 1788 he entered into partnership with Mr. Yates in an extensive manufactory at Bury. His career from this time was one of great and uninterrupted prosperity. He appears to have first come forward as a politician in 1780, by the publication of a pamphlet entitled "The National Debt productive of National Prosperity." In 1788 he married Ellen, daughter of Mr. Yates. In 1790 he was returned to Parliament as one of the members for Tamworth, in and near which borough he had acquired large property; and from the moment he entered the House of Commons, in which he sat for the same borough in seven successive parliaments, or to the end of the reign of George III., he was a steady and zealous supporter of the government. He was created a baronet 29th November, 1800. He died at his seat of Drayton Park, in Staffordshire, 3rd May, 1830.

PEEL, SIR ROBERT, second baronet, son of the preceding and one of the most illustrious of English statesmen, was born on 5th February, 1788, at Chamber Hall, Bury, Lancashire. Destined by his father for public life, he was carefully educated at Harrow and Oxford, and at the latter place he was the first who, under the new examination statutes, took a first class both in classics and

in mathematics. In 1809, being then in his twenty-second year, he entered Parliament as member for Cashel, and made his maiden speech in the following year on seconding the usual address to the Crown. In 1811 he was made under secretary to the colonies, and when in the following year Lord Liverpool took the helm of state into his feeble hands, he transferred Peel to the more important post of secretary for Ireland. This position was at the time one of extreme difficulty, for Ireland was teeming with conspiracy, and the Catholic claims were being vigorously pressed upon the attention of Parliament by O'Connell, but it was one in which the eminently practical character of the young minister stood him in good stead. Opposing so firm a resistance to the Catholic claims as to gain for himself the nickname of "Orange Peel," he endeavoured at the same time to promote secular education in Ireland, and he organized with great ability the new police, which took its name from him. In 1817 he was rewarded for his opposition to the Catholic claims by being elected member for the University of Oxford, an honour for which he was chosen in preference to Canning. The following year he resigned his Irish secretaryship, and he remained out of office during the next three years, but during this period he gave earnest support to the Tory government, and even went out of his way to defend them in the matter of the "Peterloo massacre." In 1819 he was appointed chairman of the bullion committee, and on the 24th May of the same year he moved and carried four resolutions of the committee in favour of a return to cash payments. In 1820 Peel married Julia, youngest daughter of General Sir John Floyd, who bore him five sons and two daughters. Two years later he became home secretary under Lord Liverpool, and discharged the duties of that office with an industry, tact, and ability that greatly augmented his influence in the House and in the country. With Mackintosh and Romilly he laboured to improve the criminal law, and mitigate the unwise severity of a Draconian penal code, and the five Acts which were introduced by him and passed under his direction, consolidated what had been spread over 130 Acts of Parliament, at once simplifying and humanizing the criminal law of England. After a brief interval of opposition, in 1827 Peel became home secretary and leader of the House of Commons under the Duke of Wellington, and in 1829 it fell to his lot to advocate those concessions to the Roman Catholics which he had previously opposed with so much energy. By his party he was fiercely denounced as a traitor, but having satisfied himself of the public expediency of the measure, he calmly faced the storm, resigned his seat for Oxford, and took refuge in the close borough of Westbury, whence he afterwards removed to Tamworth, for which he sat till his death. Catholic emancipation was forced on Peel by circumstances, and an Irish rebellion was averted at the cost of his character for consistency. He now opposed the national demand for parliamentary reform with as much vigour as he had previously denounced any concession to the Catholics; but the nation was in earnest in its demand, and in November, 1830, Sir Robert Peel, as he now was, for his father had died in the preceding May, quitted the home secretaryship, during his second tenure of which he had, in spite of much clamorous opposition, passed the important Metropolitan Police Act (10 Geo. iv. c. 44). The slang terms for police-constables, "Bobby" and "Peeler," are derived from Sir Robert's names. In the first reformed Parliament he took the lead of the Tory party, then reduced to barely 150 members, and under his skillful guidance Toryism became Conservatism, and in the course of a few years the Conservatives were as strong in the reformed Parliament as the Tories had been in the unreformed. In 1834, during his absence on a tour in Italy, he was summoned by William IV. to form an administration. The Duke of Wellington provisionally

conducted the government until his return to England, when he immediately dissolved Parliament and appealed to the country to support him in a policy of moderate and practical reform. His party, however, could not secure a majority in the House of Commons, and in April, 1835, being defeated by Earl Russell on a motion in connection with Irish Church reform, Sir Robert was compelled to resign. The Whigs then took office, and retained it until 1839, when the Melbourne ministry gave way to Peel's persistent and skillfully-conducted attacks. As the queen, however, refused to allow him to interfere with her household arrangements, Sir Robert would not retain office, and Lords Melbourne, Russell, and Palmerston returned to power. In May, 1841, they were defeated by a majority of one on a vote of want of confidence, owing chiefly to the weakness of their financial measures. Lord Melbourne appealed to the country, but the new Parliament (27th August) gave Sir Robert a majority of ninety-one, and he accordingly became first lord of the Treasury, with Lyndhurst, Graham, Stanley, Goulburn, and Gladstone as his principal colleagues. He now addressed himself to the development of a bold financial policy: introduced the famous sliding scale (9th February, 1842), effected the imposition of an income tax (11th March), swept away numerous protective customs duties (10th May), and carried his important Bank Act (1844), which he regarded as one of the most important achievements of his life. Meanwhile, a strong feeling had arisen in the country against the corn laws; and the agitation for their repeal, led by Cobden and Bright, and encouraged by Lord Russell and the leading Liberals, became too strong to be long resisted. Peel was fettered by the traditions of his party, but his cautious intellect once convinced of the necessity and political importance of the change, he did not hesitate to abandon his attitude of opposition. His cabinet, however, refused to support him, and in December, 1845, he resigned. Earl Russell proved unable to form a ministry, and Sir Robert again resumed office, getting rid of his more obstinate colleagues. In January, 1846, he introduced his great measure for the repeal of the corn laws, and with the assistance of the Liberals, carried it through both houses. As soon as it had received the royal assent, Peel, aware that he had lost his influence over his party, gave in his resignation to the queen. Earl Russell was called to the direction of affairs, and received for the next four years his great rival's patriotic and independent support. Day by day his popularity with the country increased; and there can be little doubt that he would again have returned to power at the head, perhaps, of a ministry composed of the more moderate Liberals and advanced Conservatives, when his career was suddenly cut short. Riding up Constitution Hill on the 29th of June, 1850, his horse threw him and fell on him, and his left collar-bone was broken. He lingered in agony for a few days, and, to the deep grief and regret of friends and opponents, expired on the 2nd of July, in his sixty-third year. He was interred in the parish church of Drayton, the funeral, according to his strict directions, being entirely private.

The domestic life of Sir Robert Peel was marked by the exercise of every virtue; as a husband, a father, a friend, and a landlord, he was almost faultless. He will long be remembered as a munificent and discriminating patron of art; and to literary men his generosity was as boundless as it was unostentatious. His manners, though reserved, were graceful and winning. His scholarship was ripe, and in conversation or in debate he was never at a loss for an apposite illustration or felicitous quotation. As a parliamentary leader he has not been surpassed. He managed the House of Commons with a tact that almost seemed like inspiration. Though no orator, for he was no enthusiast, he proved himself an able and ready debater, and particularly excelled in lucid financial and commercial

statements. His self-control was great, and however goaded by an unscrupulous opponent, he preserved his temper and retained his courteous tranquillity of bearing. As an administrator he may justly be compared with Walpole, whom in many other points he closely resembled. As a statesman he lacked the sagacity of a Burke, the brilliancy of a Gladstone, the steadfastness of a Russell; but his mind was never at a standstill. His genius was low in maturing, but eminently progressive. His rectitude of purpose and purity of motive may not be doubted; and it is certain that if circumstances compelled him to abandon his party, he never betrayed the country he loved so well and served so faithfully.

(See "Memoirs of Sir Robert Peel," edited by his literary executors Earl Stanhope and Viscount Cardwell, two vols. Lond. 1857; "Life of Sir Robert Peel," a historical sketch by Lord Dalling and Bulwer, London, 1874; Künzels "Leben und Reden Sir Robert Peels," 1851; and Guizot's "Sir Robert Peel," 1857.)

PEELE, GEORGE, an Elizabethan dramatist, was a scion of an old family of Devonshire, and was born in 1553. In 1564 he was a member of Broadgates Hall, now Pembroke College, in Oxford: he took his degree of B.A. in 1577, and was made M.A. in 1579. In no long time afterwards he appears to have married a wife with some property and then to have removed to London, where he adopted a literary career. Though the particulars of Peel's career are but very imperfectly known, there is evidence enough to show that it was not only unfortunate but disreputable. He was dead in 1598, when Meres, in the second part of his "Palladis Tamia," described his death as having been caused by his debaucheries. His earliest known drama was printed in 1584. In 1828 Mr. Dyce published an excellent edition of "The Works of George Peele, with some Account of his Life and Writings" (two vols., post 8vo). Peele, like Greene, was one of that elder group of dramatists of Elizabeth's reign, all university men, who boldly appealed to the public instead of, as heretofore, depending upon a private patron for their support. But when plain citizens with "little Latin and less Greek" like Shakespeare began also to write for the stage, these scholarly men were disposed to feel jealousy. [See GREENE.] The chief works of Peele that we know are a rather elegant courtly pastoral, "The Arraignment of Paris," wherein the apple is given by consent of all the goddesses to the queen herself, spectatress of the play (1584); a stirring "Furwell" to Drake when he set out to "sing the Spanish king's beard" the year after the Armada (1589); "The Tale of Troy" (1589); and "An Old Wife's Tale" (1595).

PEEP-O'-DAY BOYS, the once well-known appellation of certain insurgents who appeared in Ireland in 1784. They were so termed from their visiting the houses of their antagonists, called Defenders, at break of day, in search of arms.

PEEPUL TREE (*Ficus religiosa*) is a species of fig (*Ficus*), native of India, and considered sacred by the Hindus. See FIG.

PEER and PEERAGE. See NOBILITY.

PEE'WIT. See LARWING.

PEGASUS, the Latin name of the winged horse Pégasos of the Greek mythology, which Medousa the Gorgon bore to Poseidón in the temple of Athênâ, wherefore the insulted goddess turned her lovely hair to serpents. Or it is elsewhere fabled that Pégasos sprang forth from the trunk of the Gorgon when Perseus had struck off her head near the springs (*práta*) of the great salt-river which encircled the ancient world, the stream Okeanos. Pégasos, however born, at once flew up to heaven, and became the horse of Zeus, the rattle of whose hoofs as he bare the lightning among the clouds caused the thunder. Eós, goddess of the dawn, is often figured as riding on Pégasos.

In many of the legends of the mythological heroes,

Pegasus figures; as, for instance, in the famous contest of song between the Pierides and the Muses, when Mount Helikôn, inspired by the strains of the latter, began to rise towards heaven till restrained by a kick of the divine horse. From the spot where Pegasus kicked the mountain gushed forth the spring Hippokrênê, whose waters inspired to poetry and song ever after. The chief legend about Pegasus is that of BELLEROPHON.

PEGASUS, in astronomy, one of the forty-eight constellations of Ptolemy. The constellation is not a whole horse, but only the head, fore legs, and shoulders, to which a pair of wings is attached; nor is there any fountain near the place in the skies, except that with which Aquarius feeds one of the fishes. The figure of Pegasus is inverted, the head being further from the North Pole than the body. The constellation is surrounded by Cygnus, Equuleus, Aquarius, Pisces, and Andromeda. There are three bright stars, α (or Markab), β (or Scheat), γ (or Algenib), which form a rectangular figure with α Andromeda, such as cannot be mistaken when the latter constellation is known. See PLATE CONSTELLATIONS, Northern Hemisphere.

PEGASUS. See DRAGON-FISHES.

PEGMATITE is a kind of GRANITE in which mica is almost or entirely absent. When the quartz and felspar crystals are so shaped and arranged that a polished section of the rock exhibits a slight resemblance to Hebrew writing, the rock is known as *graphic granite*.

PEGU' (*Pai-gú*), a division of the province of British Burma, comprising the districts of Rangoon, Thun-khwa, Bassein, Henzada, Tharawadi, Prome, and Thayet-myo, which see separately. The area is 27,000 square miles, and the population about 1,700,000. It was occupied in consequence of the war in 1852, and in 1862 was united with the adjoining districts of Tennasserim and Aracan under one local administration, the whole territory being called British Burma. Since its occupation by the English slavery has been abolished, schools established, and various public works undertaken. The surface of the country is flat or undulating; and the climate warm and moist, but healthy. The soil is very fertile, and produces rice, teak, gums, and dye-woods. The minerals comprise iron, tin, lead, and precious stones.

PEGU, the chief town of the above division, situated on the Pegu River, 20 miles west of the Tsit-toung. It contains court-houses, police stations, a market, post-office, and a government school. The houses are built of wood and bamboos, and are thatched or tiled; the present population is only 5000. Pegu is described by European travellers in the sixteenth century as of great size, strength, and magnificence. After the capture of Rangoon during the first Burmese War, the Burmese commander-in-chief retired to Pegu, and his forces becoming thinned by desertion, the inhabitants rose against him and handed the place over to the British, who garrisoned it with a small body of troops. During the second war, it was more stubbornly defended.

PEGU', a river in the Rangoon District, Pegu Division, British Burma; rises in lat. 18° N., and lon. 96° 10' E., on the eastern slopes of the Pegu Yoma Mountains, and flows first S.S.E. past the town of Pegu, then S.S.W., and finally joins the Rangoon or Hlaing River, in lat. 16° 45' N., and lon. 96° 11' E., near Rangoon city, after a total course of 180 miles. At its mouth it is about a mile broad, and can be ascended by large vessels as far as the Pu-zwon-doung, where they take in cargoes of rice, cleaned in the steam mills on the banks of that stream. At neaps the tide is felt as high as Pegu, and during springs a bore rushes up the river almost as far. In the rains, the Pegu is practicable for river steamers up to Pegu town. It taps a country rich in teak and other valuable varieties of timber, and in the lower part of its course irrigates a considerable area under rice cultivation.

PEIHO' or **TIENTSIN-HOA**, a river of China, which, rising near the Great Wall, flows south-east, passing Peking and Tientsin, and enters the Gulf of Pe-chi-li, in lat. 38° 38' N. It is navigable for boats to Tingchan, 12 miles from Peking, and 108 miles from its mouth. Its basin is subject to disastrous floodings. The famous Taku forts, which were stormed and taken by the British in 1860, are situated at this point.

PEINE FORTE ET DURE. The "strong and hard pain" which is denoted by these words was a species of torture used by the English law to compel persons to plead when charged with crimes less than treason, but amounting to felony. It was applicable whenever the accused stood mute on his arraignment, either by his refusal to put himself upon the ordinary trial by jury, or to answer at all, or by his peremptory challenging more than twenty jurors, which was a contumacy equivalent in construction of law to actually standing mute. In the reign of Edward I., when the first traces of this punishment appears in the history of the English law, it consisted merely of severe imprisonment, with a diet barely sufficient to prevent starvation, until the offender consented to put himself upon his trial. In the reign of Henry IV. the practice of loading the sufferer with weights and pressing him to death appears to have been the regular course. The judgment upon persons standing mute, approved by all the judges in 1406, was "that the marshal should put them in low and dark chambers, naked except about the waist; that he should place upon them as much weight of iron as they could bear, and more, so that they should be unable to rise; that they should have nothing to eat but the worst bread that could be found, and that on the day on which they had bread they should not have water; and that they should lie there till they were dead." From this period till 1772 pressing to death continued to be the lawful mode of execution for criminals who stood wilfully mute upon their arraignment for felony, and it is said the punishment was actually inflicted as late as 1741. The press-yard at Newgate retains its name as derived from this barbarous practice. Many instances are recorded of the infliction of this punishment. *Peine forte et dure* was discontinued in consequence of the statute 12 Geo. III. c. 20, which provides that every person who shall stand mute when arraigned for felony or piracy shall be convicted of the same, and the same judgment and execution shall be awarded against him as if he had been convicted by verdict or confession. The law in this respect has been altered by the statute 7 & 8 Geo. IV. c. 27, a plea of "not guilty" being entered on the record if the prisoner refuses to plead.

PEIRAIÆUS (Lat. *Piræus*) was the most important harbour of Athens, and was situated in the peninsula about 5 miles south-west of the city. The whole peninsula bore the name of the chief harbour, but besides Peiræus there were Mounuchia and Zœa. Themistoklès chose this site after the Persian wars, as superior to the old harbour of Phaléron, and in remembrance of this his tomb was erected at the entrance. This was very narrow, and was made still narrower by the piers, and protected by a heavy chain in times of danger. Themistoklès surrounded the whole peninsula with strong fortifications, and Periklès connected it with Athens by the two *long walls*, making a narrow protected passage from city to harbour $4\frac{1}{2}$ miles in length; a wall leading to Phaléron, making a third defence, at a slight angle to the other two. These famous walls were thrown down by Lysandros (Lysander) B.C. 404, but were rebuilt by Konôn B.C. 393, on the temporary revival of the Athenian fortunes. The Phalæic wall was not, however, rebuilt.

PEIRITHOOS, the son of Ixion, in the Greek mythology, was king of the Lapithæ. He married Hippodameia; and it was at this marriage feast that occurred the

celebrated fight between the Centaurs or Kentauri (Lat. *Centaurs*, half men half horses) and the Lapithai, which is represented so splendidly in the bas-reliefs on the metopes of the Parthenon. One of the Centaurs became intoxicated, and sought to carry off the bride, whence arose the fight, which resulted in the victory of the Lapithai. Theseus, king of Athens, assisted in this fight. The two kings made many expeditions together, but the last of them was the most famous. Hippodamia being dead Peirithoos had desired to marry again, and Theseus proposed that they should each wed a child of Zeus. Theseus carried off Helena (afterwards rescued from him, and destined to become the bride of Menelaos and cause of the Trojan War); Peirithoos determined to attempt to carry off Persephone, queen of Hades, the under world. His friend descended to Hades with him, but Plouton (Pluto), enraged at the insult, seized them and chained them fast with 300 chains. Herakles when he descended to the shades released his friend Theseus, who had only been accessory to the crime; but was not permitted to release Peirithoos, and the latter remained in everlasting torment.

PEISISTRATOS (Lat. *Pisistratus*), the famous tyrant of Athens, was of most distinguished (quasi-divine) birth, and of singular beauty and accomplishments. He was a relative and a close friend of the great legislator Solon (Gr. *Solon*). Nevertheless when his design of seizing arbitrary power became apparent Solon opposed him, and when Peisistratos, appearing with self-inflicted wounds, demanded a permanent guard against his enemies, Solon pointed out that this might be the nucleus of a trained force. He was respectfully listened to, but his monition was in vain. The result was that the Akropolis was soon seized by force and Peisistratos became despotic ruler (Gr. *tyrannos*, tyrant) of Athens. The word *tyranny* must be held to imply only the arbitrary rule of one person, and not any severe or cruel practices. His administration was, on the contrary, mild and excellent, and the city flourished. But after a while men rose against him and drove him out. He remained in exile six years. A second tyranny, peaceably entered upon, was followed by a second expulsion of ten years. This time Peisistratos returned by force, defeating the Athenians with a considerable body of troops; and he took such measures as consolidated his power; for instance, claiming children of the chief citizens as hostages, and sending them away with one of his own adherents, &c. Nevertheless, like the Roman Cæsars, he made no outward change in the constitution; simply he and his friends always filled the various offices arranged by Solon, to the exclusion of other citizens. He made great additions to the beauty of Athens, erecting the Lyceum, and beginning a great temple of Zeus. It was he who invited Thespis to begin the drama at Athens, and who arranged for a yearly contest between dramatists for a prize at the festival of the god Dionysos. He favoured poetry also, and was particularly fond of Homer; and as the great poet's verses were often incorrectly recited, he ordered a poet edition to be got together, which is what we now possess. He was the first prince to found a public library.

Peisistratos died at an advanced age in B.C. 527, and his sons Hippias and Hipparchos succeeded him. After the murder of Hipparchos by Harmodios the character of the government changed to a tyranny in the modern sense, and at length a popular revolution drove out Hippias, B.C. 510. He crossed over to Asia, and seeking the court of Persia showed how Greece might be conquered; and old as he was he accompanied the generals of Darius to the plain of Marathon, where it is said he fell in the battle, B.C. 490.

PEK'AN (*Martes pennanti*) is a species of *MARTES*, widely distributed over the northern part of North America. The pekan or fisher, as it is sometimes called, is a large species, measuring 30 inches from the snout to the root of the tail, which latter gives 16 inches more. The body is

stout, and the face is more like that of a fox than a marten. The fur is dark-brown in colour, becoming lighter on the fore part of the back; white patches are seen on the chest and belly. The pekan lives in the woods, but prefers the vicinity of water. It feeds chiefly on mice, and is said by Sir J. Richardson to kill the Canadian porcupine by a bite on the belly and devour it; it does not seem to feed on fish. The fur, though inferior to that of the sable, is valuable.

PEKIN' or PEKING', the capital of the Chinese Empire, situated on a level plain, about 14 miles from the Pei-ho River, and 100 miles from the sea. The name means "Northern Capital." The town of two contiguous cities, each separately encircled by walls, 25 miles in circuit, 30 feet high, and entered by sixteen gates, in all occupying an area of from 25 to 28 square miles, though much of this space is covered by gardens and inclosures. Over each gate is a watch-tower, 9 storeys high, and in each storey are port-holes for cannon.

The roads leading to the city are paved with blocks of granite; the streets are not paved, but are constantly watered to keep down the dust. The principal streets vary from 140 to 200 feet in breadth, but they contain no large buildings; the houses are usually not higher than one storey. The great thoroughfares are lined with a continuous series of shops. Public edifices, and also the dwelling-houses of private persons, occur only in the narrow streets and lanes.

The south or Chinese city, the seat of commerce, and the residence of the majority of the population, is intersected throughout by four wide and regular streets, which abound with shops of all descriptions, and are continually filled with a motley crowd. The chief objects of interest are—an astronomical observatory, Jesuits' burying-ground, temple of the Great Bell, and the Lama monastery, which will accommodate 3000 persons. The houses are of brick, with red-tiled roofs. There is no regular system of drainage. The northern, Tartar, or Imperial city, consists of three separate inclosures: the outer one, formerly appropriated to the Tartar garrison, is now mostly occupied by Chinese traders; but it contains five of the supreme tribunals of the empire. The second inclosure (*Hwang-Ching*, "the august city"), 6 miles in circumference, is entered by four large and several smaller gates. In it are extensive public granaries, a military arsenal and seminary, the college and buildings of the Russian embassy, the national college, and the residences of the great dignitaries of the empire. The inner inclosure, or "forbidden city," with walls 2 miles in circumference faced with yellow tiles, and surrounded by a moat, is appropriated to the public and private palaces of the emperor and empress, and has a magnificent temple of the imperial ancestors, pavilions, gardens, a lake, and an artificial mountain. Outside of both cities are open suburbs; and, besides its numerous temples and pagodas, the capital has a fine mosque, a Greek church and convent, and a Roman Catholic chapel. About 8 miles north-west of the city lies the imperial park, with lotus lakes and marble bridges, temples, and pagodas, in the midst of which the famous Summer Palace stood; it was sacked by the allied English and French troops in 1860, and remains as they left it, a heap of ruins. The population of Peking has been estimated at from 500,000 to 2,000,000. Its climate is very healthy, but the city has a somewhat decayed and dirty appearance. There is a large printing and bookselling trade, and manufactures of coloured glass, idols, and other articles. There is a canal from the city to the Peiho, by which most of the provisions for the supply of the inhabitants are conveyed. Canals are also extensively used in conveying coal from the mines of the west and goods into the country. On the 30th October, 1860, Peking was taken by the allied English and French, since which date ministers of these

two nations have resided there. The same privilege is accorded to Russia and the United States. At the British embassy there is a college for student interpreters.

PELAGIUS and PELAGIANISM. Of the birth and early history of Pelagius nothing is known with certainty, but from the appellation *Brito* given him by his contemporaries, he is usually supposed to have been of British origin, while his name is thought to be a Greek translation of the Cymric *Morgan* (*muir*, sea; *gin*, begotten). He was a monk, and he appears first in history in the opening years of the fifth century, at which period he was living at Rome, observing a very strict discipline, and stirring up by his example and counsels the indolent and profligate members of the religious fraternities there. His earliest writings show that he was profoundly impressed by the moral depravation then prevailing in Christian circles at Rome, and it was as a reformer rather than a theologian that he commenced his public work. But when he denounced the indifference to purity and holiness which existed among Christians, along with a fierce zeal for orthodoxy, and a trust in the supposed magical efficacy of the sacraments, he found men defended their inconsistency by arguments based upon the Augustinian theology, then very generally accepted in the West. Hence Pelagius was induced to examine and assail the teachings of Augustine, and in opposition to the doctrines of the total depravity of human nature, and of man's absolute dependence upon special grace for the power to obey the divine commands formulated by him, Pelagius denied the doctrines of original sin, asserted the freedom of the human will, and declared that man's responsibility was measured by his ability. His favourite maxim was "If I ought I can," and he did not hesitate to pronounce the celebrated prayer of Augustine, "My God, give what thou commandest and command what thou wilt," to be impious and absurd. His peculiar tenets were first published in his "Commentaries on the Epistle of St. Paul," which were issued at Rome in 405; but they attracted very little attention until they were publicly advocated by one of his disciples named Cœlestius, a man of a bold and ardent temperament whom Jerome calls a Scot, that is probably, in the diction of those times, an Irishman. In the year 410, when Alaric was menacing Rome, the two friends crossed to Africa, where Pelagius once or twice met with Augustine, but without entering into any contention with him, and after a short stay Pelagius sailed for Palestine, leaving Cœlestius, who was waiting for ordination, at Carthage. At Jerusalem Pelagius met Jerome, who gave him a cordial welcome, and with whom he lived on terms of friendly intimacy for the next two or three years. Meantime Cœlestius had been propagating his master's views at Carthage, and instead of obtaining ordination had been condemned and excommunicated as a heretic, at a synod held there under the Bishop Aurelius. Against this decision he appealed in vain to Rome, but managed by removing to Ephesus to procure ordination there. The attention of Augustine was called to the writings of Pelagius by the action of the synod in Africa, and he deemed it necessary to reply to them, and to send Orosius, a Spanish monk, to Jerome to warn him against Pelagius. The result of the mission of Orosius was that Jerome became hostile to Pelagius, and the latter was cited before John, bishop of Jerusalem, and charged with heresy. This prosecution broke down, and when, a few months later, a synod was held at Diospolis to consider the matter, Pelagius was formally acquitted of heresy and his doctrine was pronounced orthodox. This decision, however, only roused a more intense hostility on the part of Augustine and the churches of North Africa, and the doctrines of Pelagius were solemnly condemned as heretical by the synods of Carthage and Milevia in 416. The decisions of these synods were confirmed by Innocent, bishop of Rome, and also, after some hesitation and delay, by his successor Zosimus. In 418 the

Emperor Honorius, who had been appealed to by the champions of orthodoxy, issued an imperial edict from Ravenna, condemning the doctrines of Pelagius, and enacting that not only Pelagius and Cœlestius, but all who accepted their opinions, should suffer confiscation of goods and irrevocable banishment. This edict was followed by a circular letter of Zosimus inviting all the bishops of the Christian church to join in the condemnation of Pelagian doctrine. Nineteen Italian bishops refused to subscribe this letter, and their leader, Julian of Eclanum, continued the controversy for several years. In 431, however, the Eastern Church, at a council held at Ephesus, joined the Western Church in the condemnation of Pelagianism, which has ever since been branded as heresy. Pelagius himself disappears from history after his banishment from Rome in 418, and his subsequent fate is quite unknown. His character was assailed by some of his later antagonists, but his great opponent Augustine admits that it was unexceptionable. In person he appears to have been a sturdy slender, unlike the dry and withered monks of Eastern climes; for Jerome describes him as *Scotorum pulchus pręgrınatus*—"Made obese with Scotch porridge." Of his writings, "Fourteen Books of a Commentary on St. Paul's Epistles," his "Epistle to Demetrius," and his "Memorial to Pope Innocent," have been preserved in the works of Jerome, and many other passages from lost works may be collected from the replies of Augustine.

With respect to the doctrinal system advocated by Pelagius and since called after his name, it may be observed that it starts from the fundamental proposition that obligation to duty is limited by ability, and that sin is a thing of will and not of nature, arguing that if sin could be of nature it would be chargeable on God the Creator. Further, Pelagius asserted that Adam was by nature mortal, and that whether he had sinned or not would certainly have died; that the consequences of Adam's sin were limited to his own person; that new-born infants are in the same condition as Adam before the fall, save that they are exposed to the evil example of others, by which they may be misled; that the law qualified men for the kingdom of heaven as well as the gospel; that no special aid or grace from God was needed for particular actions, the divine grace being limited to the bestowal of free will and the aid of law and instruction; that the divine grace is given in proportion to the merit of the recipient; that pardon is granted to penitents according to their merit and labour; and that inasmuch as the whole human race did not die in consequence of Adam's sin, neither would it necessarily rise again in virtue of the resurrection of Christ.

As already narrated the victory in the controversy remained with Augustine and his followers, and the Pelagians never became a distinct sect within or external to the church. Pelagian ideas, however, were not so readily disposed of, and before the close of the fifth century a movement was initiated both in Gaul and North Africa to which the name Semipelagian has been given. The supporters of this system endeavoured to avoid the terrible hardness of Augustinianism on the one hand, and the proved errors into which Pelagius had fallen, on the other. While agreeing with Augustine, in that they ascribed generally a holy life as such to the grace of God, they yet attributed the commencement and sum of a course of acceptable actions to the force of human merit. Semipelagianism in its turn was officially branded as heresy by the Councils of Orange and Valence in 529, but the controversy continued under various forms to agitate the church throughout the whole mediæval period, and blazed up again with renewed fire at the period of the Reformation. Some of the greatest intellects which have been enlisted in the service of the church have attempted in vain to settle the doctrinal questions raised by the British monk, and though at the present day the tide of Christian thought flows in different

channels to the past, its waters are still to some extent troubled by the agitation he commenced. In connection with this subject see also ARMINIUS, AUGUSTINE, CALVINISM, FREEDOM OF THE WILL, JANSENISM, NECESSITY, ORIGINAL SIN, and PREDESTINATION.

PELAGIUS was the title borne by two of the early popes.

PELAGIUS I. (556-560) had been the legate of Pope Vigilius to the Emperor Justinian, and had won great wealth in Constantinople, in a manner not altogether above suspicion. But when in 547 the city was besieged by Totila, he did not hesitate to expend the whole of his fortune among the famishing inhabitants. He dared to go on an embassy to Totila, and when all was in vain and the Gothic king entered the conquered city, it was Pelagius alone who was bold enough to confront him, Bible in hand, and gain some mercy at his hands by his dignified calmness. The massacre and spoliation which had begun were arrested. Nevertheless when in 556 Pelagius succeeded Vigilius (whom Justinian had bitterly persecuted) he was resisted by the whole church. Justinian had appointed him, but three bishops could not be found to consecrate him. Accusations were not wanting against him that he had instigated the imperial cruelties against Vigilius. After he had solemnly sworn his innocence of this upon the gospels and the cross his rule was better received; but his friendship with Justinian kept the Western bishops aloof, and he was repeatedly challenged as to his action. He even felt compelled to cause some of the most refractory bishops to be imprisoned and sent to Constantinople.

PELAGIUS II. (578-90) is chiefly memorable, first for having been elected at Rome without the command or consent of the Byzantine Emperor, unlike his predecessors; and secondly for his earnest denunciation of the title of "Œcumenical patriarch" assumed by the patriarch of Constantinople and confirmed by a council there. He was succeeded by Gregory the Great.

PELARGONIC ACID, an oily acid, found in the leaves of *Pelargonium roseum*, natural order Geraniaceæ, from which it may be obtained by distillation. It is usually prepared artificially by the oxidation of oleic acid or of oil of rue by nitric acid. It is a colourless oil, solid at low temperatures, melting at 10° C. (50° Fahr.), and boiling at 260° C. (500° Fahr.). The odour resembles that of butyric acid. It is slightly soluble in water, very soluble in alcohol and ether. The formula is $C_{15}H_{25}O_2$. It forms a number of crystalline salts, called pelargonates, having the general formula $C_{15}H_{23}MO_4$. Pelargonate of ethyl or pelargonic ether ($C_{11}H_{21}O_2$) is a liquid of specific gravity 0.862, and boiling at 250° C. (482° Fahr.). It has a powerful vinous odour. The aroma of certain wines is due to this ether, which is formed during the process of fermentation.

PELARGONIUM (Gr. *pelargos*, a stork) is a genus of plants belonging to the order GERANIACEÆ, and containing the brilliantly coloured garden plants known as geraniums. *Pelargonium* differs from the wild geranium or crane's-bill [see GERANIUM] in the irregular corolla, in the posterior sepal being prolonged into a spur adherent to the peduncle, and in some of the outer stamens being rudimentary. The species are numerous, chiefly inhabiting the Cape of Good Hope; a few are Australian, one is found in the Canary Islands, and another in Asia Minor. Some species have a well-developed leafy stem, others have an underground stem or rhizome, and others are undershrubs, with thick fleshy stems; some have tuberous roots, which are eaten or employed medicinally. The leaves are opposite, the upper ones sometimes alternate, entire, or variously divided, with two stipules at the base of the petioles. The flowers are usually in stalked involucre umbels, which are either opposite to the alternate leaves or axillary.

The species are extensively cultivated in this country on

account of the beauty of the flowers, and some for their scent. Most of the garden forms are hybrids, which are easily obtained in this genus. From some species a very sweet volatile oil is obtained by distillation.

By care and attention to a few simple points of practice, these plants may be cultivated and multiplied by any one who has a greenhouse, and hence they have become universal favourites. Those points are the following, namely:—(1) water; (2) warmth; (3) a gentle bottom heat; (4) abundance of air; (5) as much light as the leaves will bear; and (6) a rich soil during the season of growth, and a cool atmosphere, less water, abundance of light, and close pruning afterwards. Many of the species are cultivated in the open air, care being taken to remove them to a dry cellar or room before the frost comes on. In this case every leaf must be cut off, and no water supplied throughout the winter.

PELASGOI were the most ancient inhabitants of Greece, as far as the knowledge of the Greeks themselves extended. The Greek traditions represent the Pelasgic race as spread most widely over almost all parts of Greece and the islands of the Grecian Archipelago, the western coast of Asia Minor, and the south of Italy. To them the chief gods of Greece owed their earliest worship, the Dodonaian Zeus, the Kabeiroi, Hēphæistos, &c.; so said the Hellenes. This would imply a kinship of race. But, on the other hand, Herodotus expressly says the Pelasgoi, still existing in his time in scattered communities here and there, did not speak Greek, but a barbarous tongue. The truth is, that absolutely nothing but the tradition of the name can be proved of this people, if indeed there ever was such a people. Meanwhile the term serves to denote the pre-Hellenic inhabitants of Greece; and the epithet Pelasgic or Cyclopean is given to curious monuments of prehistoric architecture, such as that which is called the "Treasury of Atreus" at Mycenæ (*Mikenæ*).

PELECANIDÆ is a family of birds belonging to the order ANSERES. It is now usually considered as a suborder, under the name Steganopodes, and is subdivided into several families. In the birds of this family, with the exception of the Tropic-bird, the cheeks, throat, and parts about the base of the bill are more or less denuded of feathers. The skin of the throat is very dilatable, the tongue is small, and the nostrils are mere slits not easily distinguishable. The beak is long, but varies in form. All the toes are united by webs, the hind toe having an oblique direction inwards, instead of being completely directed backwards. The legs are generally short and stout, and the wings ample. These birds are powerful on the wing, and excellent divers and swimmers. Some, in spite of their webbed feet, perch with facility on trees. This family includes the PELICAN (see Plate, fig. 2), GANNET (fig. 4), CORMORANT (fig. 1), DARTER (fig. 3), FRIGATE-BIRD, and TROPIC-BIRD.

PELÉ'S HAIR. In molten lavas the escape of imprisoned steam and other gases is sometimes so vigorous that the glassy fluid in places is blown into innumerable threads as fine as hair. This phenomenon is especially frequent round the crater of Kilaua, in the Sandwich Islands, and Pelé being the mythical goddess of that mountain, the masses of fine threads are commonly known as "Pelé's hair." A similar product is obtained artificially by passing steam through glass slag, and this is largely used for the packing of boilers.

PE'LEUS, one of the principal legendary heroes of the Greek mythology, the father of Achilles, and in some sort the cause of the Trojan War, was the son of Aïakos, king of the island of Aigina, close to Athens. He and his brother Telamon killed their half-brother Phōkos out of jealousy, and on discovery were punished by banishment. Peléus repented of his crime and was purified by Enrutión of Pithia in Thessaly. He married the daughter of his benefactor, and settled near him as a subsidiary prince. As he

had, of course, no followers, he prayed to Zeus that he would help him to some, and the god, willing to grant his prayer, and beholding a swarm of ants in the fields (Gr. *murmēkes*, ants), turned them into stout men-at-arms, fully equipped, who were hence called Myrmidons (Gr. *myrmidones*). The faithfulness of these men to their chiefs, Peleus and Achilles, was so great that it has passed into a proverb, and "surrounded by his myrmidons" is an epithet which is often used, by fine writers, as applicable to a man possessed of a bodyguard of followers knowing no law but his order. In this way the word, so honourable, has come to have somewhat of an evil flavour. As to the miracle itself it is on the face of it a piece of clumsy FOLK-ETYMOLOGY. The puzzle was to account for a group of middle Greeks in Northern Thessaly, bearing a peculiar name, and the difficulty was solved by an antique pun. In the great boar-hunt of Kaludón both Peleus and Euratiôn served under Meleagros, and in the encounter with the monster Peleus accidentally slew his friend. He fled to Iolkos, where he received a second purification from blood-guiltiness at the hand of Akastos. But the queen of the latter fell in love with the handsome and dauntless hero, and as he loyally refused to deceive his friend she falsely accused him to Akastos, as Phaidra did Hippolitos to Theseus. Akastos could not but believe his queen, and though he refused to slay him whom he considered his betrayer, since he was a guest and a suppliant, he yet cast him out on Mount Pelion, swordless, to the mercy of the wild beasts. Here the goddess Thetis saw the hero sleeping, and loved him. The Centaurs (Gr. *Kentauroi*) also came to his help, and when he married Thetis they gave him splendid presents and a banquet. The gods were invited, but one omission marred the list: the goddess of strife, Eris, was not included; and really one could pardon the omission, considering the friendly nature of the feast, even if it had been intentional, which it was not. In the middle of the banquet, the fruit yet upon the tables, the angry goddess arrived uninvited, and throwing upon the table a golden apple, upon which she had written "For the loveliest one," at once retired. All the goddesses present claimed the prize, and the banquet ended amid their quarrels; but it soon became manifest that the chief competitors were Héra, Athena, and Aphrodite. How the decision of the Trojan shepherd-prince Paris, in favour of the latter, brought about the war of Troy is recounted in the articles PARIS and ILIAD. As for Peleus he joined the expedition of the Argonauts, and on his return to Phthia, where he now ruled, assembling his Myrmidons, and assisted by Jason (Jasôn) he attacked Iolkos, defeated the king Akastos, slew the traitress-queen, and led his army into the city over her body. When the war of Troy broke out he was too old to take part in it; but he survived Achilles, the chief hero in that immortal exploit.

PELEW ISLANDS, a chain of small islands situated in the Pacific, between 7° and 9° N. lat., and between 134° and 136° E. lon. They are about twenty in number, all of coralline formation, flat, and afford no secure anchorage. The area is about 346 square miles. The climate is mild and agreeable, and there are no rivers, but the inhabitants are supplied with water from brooks and ponds. The produce is wholly of a tropical character. Cattle, goats, and fowls thrive, and fish abound along the coast.

The natives are a tribe of Malays. Their huts are made in a very simple way, but they show some ingenuity in the construction of their boats. Their cooking utensils are made of clay, and are burned in the same manner as our coarse pottery. They live almost entirely on the produce of their fishing and cattle. They are excellent seamen. These islands are claimed by Spain, but their right is not acknowledged by England and Germany.

PELIAS, in the Greek mythology, brother of Néleus, and son of the god Poseidôn, by the nymph Turô. The brothers

seized the throne of Iolkos, and Pelias subsequently drove out Néleus and reigned alone. Jason, the rightful heir to the throne, claimed it, and was promised the peaceable succession on arriving at manhood if he would procure the golden fleece of Kolchis, whence came the expedition of the Argonauts. This, and the fate of Pelias, is told in the article JASON. Alkêstis, the heroine of the noble play of Euripides, was a daughter of Pelias.

PELICAN (*Pelecanus*) is a genus of Anserine birds belonging to the family PELECANIDÆ. The pelicans are distinguished by their very long but weak bill, of which the upper mandible is terminated by a hook, and the lower is furnished with an enormous pouch formed of a naked catery skin. In this pouch the pelicans are enabled to store up the fishes which they capture. The Common Pelican (*Pelecanus onocrotalus*, fig. 2, Plate PELECANIDÆ) found in South-eastern Europe and many parts of Southern Asia and North Africa. It appears occasionally to stray into Germany, but the birds that have been taken in that country may have escaped from zoological gardens. Two specimens have been recorded as having been shot in England, but in both cases they were proved to have escaped from confinement. In prehistoric times a pelican, belonging either to the present or the following species, did inhabit our island, portions of its skeleton having been found in the fens of Norfolk. The common pelican is



Foot of Pelican.

between 5 and 6 feet in length, and 12 and 13 in expanse of wing. The plumage is white, with more or less of a rosy tinge; the primaries are black. The nail at the tip of the upper mandible is bright red, and it has been suggested that the ancient story of the pelican feeding her young with blood from her own breast originated from its habit of pressing the bill against the neck and breast in order to discharge the contents of the pouch, during which action the red tip of the mandible would come into contact with the breast. The pelican haunts the sea-coasts, rivers, and lakes, preying upon fish. It swims and dives exceedingly well, and notwithstanding its large size and webbed feet perches freely upon the branches of trees. The nest is composed of grasses, sedges, and other aquatic plants, and is placed close to the edge of the water; in it are laid two white eggs. A rarer but somewhat larger species, *Pelecanus crispus*, also inhabits Southern Europe. It is distinguished from the previous species by the purer white of its plumage, and by the curled feathers on the back and sides of the head. The Brown Pelican (*Pelecanus fuscus*) is common on the coasts of both North and South America; and another species, much resembling the common pelican, is found also inland in North America. Two other species are recognized, one in Australia, and one in Southern Asia.

PELION, the ancient name of a wooded mountain range in Thessaly, now known as Zagora. On the east it descends in rugged and abrupt precipices to the sea. The

giants in vain piled Pelion upon the neighbouring Ossa in their war with the gods, in their efforts to reach the summit of Olympus. [See Ossa.] Near the top of Pelion used to be shown the cave of the centaur Cheiron; and the wood of the Argo was felled in the forests upon the sides of the mountain.

PELITE (Gr. *pēlos*, clay), the modern scientific name for a clayey (or argillaceous) sedimentary rock.

PEL'LA, the ancient royal city of Macedonia, and the native town of Alexander the Great, hence called the Pellean youth.

"Unus Pelleo juveni non sufficit orbis."

—*Juv. "Sat."* x. 168.

It was situated on a hill near the Lake Borborus, and sank into decay after its capture by the Romans in 168 B.C.

PELLAGRA (Ital. *pelle agra*, smarting skin) is the name given to a peculiar disease found chiefly among the peasantry of Northern Italy, in the Asturias, Gascony, Roumania, and Corfu. Its origin and prevalence are usually traced to the use of inferior, unripened, and damaged maize as a staple article of diet, and it is fostered and increased by heredity and the conditions of poverty, hardship, and filth in which the victims live. A maize diet, under favourable conditions, will not give rise to this disease, nor does it appear as a result of hardship and misery apart from the use of this article of food. In the districts referred to the peasantry were wretchedly poor, are hard worked, badly lodged, and very poorly fed—porridge made from inferior maize flour, or some half-baked bread from the same material, being their chief article of diet.

The disease usually makes its appearance early in the spring of the year as an affection of the skin, the parts of the body most affected being the backs of the hands, the neck, and the breast. Dark red blotches appear, forming a rash, the spots being tense and painful, especially when exposed to the sun. Soon after small tubercles arise upon the inflamed blotches, and the skin becomes dry and scaly, and often deeply cracked. During the progress of the malady the person affected becomes weak, weary, giddy, and has also headache, burning in the hands and feet, cramp and neuralgic pains, sickness, and diarrhoea. These symptoms subside as summer advances, desquamation of the skin takes place, and by the autumn the patient appears to have fully recovered. The following spring, however, the symptoms return with greater intensity, affecting more deeply the nervous system and brain, and this may be repeated for a few years, until the victim of the disease becomes a prey to melancholia, lunacy, or incurable idiocy. The sense of misery induced by the disease frequently leads to suicide, especially by drowning, and hence this form of insanity is sometimes known as hydromania. Where the disease itself terminates fatally the symptoms are rapid wasting, attended by profuse and fatid perspiration, severe diarrhoea, and dyspepsia.

The treatment of pellagra offers little prospect of success as long as the patient remains exposed to the same influences by which he was rendered subject to its attack. The course usually adopted by the Italian physicians for the patients who are admitted into the hospitals is to give a liberal allowance of wholesome food, and to administer tonic and strengthening medicines of various kinds. That a tendency to the disease is hereditary seems undoubted, but there is no evidence that it is contagious. During recent years the prevalence of this disease has attracted the attention of physicians, philanthropists, and statesmen, and it is to be hoped that some serious efforts will be made in the future to ameliorate the hard conditions of life among the peasantry which have given rise to this terrible affliction.

PEL'LICO, SILVIO, an Italian poet and patriot, was born at Saluzzo in Piedmont, 24th June, 1788. In his sixteenth year he accompanied his twin sister Rosina on her marriage to Lyons, where he lived four years, and

where he studied French literature so earnestly as almost to forget his own language. At the end of this period, however, the reading of Foscolo's "Carne de' Sepolcri" awakened his latent patriotism, and he returned in 1810 to Milan, where his family had settled, and became professor of French in the College of Military Orphans. This institution fell with the French power, and Silvio became tutor first in the family of Count Briche, and afterwards to the sons of Count Porro, in whose house he met many persons of note, as Monti, Foscolo, Volta, Manzoni, Madame de Staël, Byron, and Brougham. The appearance of Carlotta Marchionni on the Milan stage induced him to compose for her the tragedy "Francesca da Rimini," and he followed this by another, "Eufemio da Messina," the representation of which, however, was forbidden. In 1818 he was appointed manager of the journal entitled *Il Conciliatore*, which after a run of a year was suppressed by the Austrian government, and the following year Pellico, who through his friend, the poet Maroncelli, had become connected with the Carbonari, was arrested and consigned to the prison of Santa Margherita. In 1822 he was tried and sentenced to death, but the sentence was commuted to fifteen years' imprisonment, and he was in the same year placed in the Spielberg at Brünn. In August, 1830, the remainder of his sentence having been remitted, Pellico was set at liberty, and returned to dwell among his own people. During his imprisonment he had busied himself with literary work, and on his release he published numerous tragedies and religious works, of which the list is far too long to be given here. One of these works, however, "Le Mie Prigioni," the story of his imprisonment, related with a pathetic simplicity of the most charming character, gave him a European fame, and caused his name to become known in quarters where his poetry had never been heard of. This book has gone through innumerable editions, and has been translated into most European languages. He died at Turin, 31st January, 1854. See Chiala's "Vita di Silvio Pellico" (Turin, 1852), and the work of Bourdon (1868).

PEL'LITORY (*Parietaria*) is a genus of plants belonging to the order URTICACEÆ. The Pellitory of the Wall (*Parietaria officinalis*) is common on old walls and stony places in Britain and Ireland, but not in the North of Scotland; it is also found throughout Europe and Russian Asia. It is a branching herbaceous perennial, about a foot in length, with a reddish brittle stem, which becomes prostrate after the first year, oblong ovate entire leaves, and clusters of small greenish flowers in the axils of the upper leaves. In addition to the male and female flowers there are a few hermaphrodite flowers which seldom ripen their seed. The pollen is discharged in the form of a little cloud of dust through the expansion of the filaments by the action of the sun on a hot summer's day, or by mechanical irritation. This plant contains nitre, and was formerly used medicinally.

The Pellitory of Spain is the name given to the root of a totally distinct plant, *Anacyclus Pyrethrum*, belonging to the order COMPOSITÆ, and resembling nearly the camomile. *Anacyclus Pyrethrum* is a native of Barbary, Arabia, and Syria, and is cultivated elsewhere for use in medicine. The root is exported in cylindrical or tapering pieces about the size of the little finger. It is a powerful irritant. It is sometimes employed in toothache, being chewed or administered in the form of a tincture. When chewed it causes a burning and tingling sensation in the lips and tongue, and causes the saliva to flow freely. It is also sometimes used in neuralgia and headache, but is seldom taken inwardly.

PELOPONNESIAN WAR is the name given to the great contest between Athens and her allies, on the one side, and the Peloponnesian confederacy headed by Sparta, on the other, which lasted from 481 to 404 B.C. It

arose from the jealousy with which Sparta and Athens regarded each other; each was aiming at supremacy in Greece, as the heads respectively of the Dorian and Ionian races, and as patrons of the two opposite forms of government, oligarchy and democracy. A truce for thirty years had been concluded between them in the year B.C. 445, but the occasion for a quarrel was presented by the affairs of Korkyra (modern Corfu) and Potidaia. In B.C. 436 the Korkyraians applied to Athens for assistance in a quarrel with Corinth, and an Athenian fleet was sent to their aid.

Potidaia, on the isthmus of Pallênê, was a Corinthian colony, and even after its subjugation to Athens continued to receive every year from Corinth certain functionaries or officers. The Athenians, suspecting that the Potidaians, led on by the arts of Perdikkas, king of Macedonia, were inclined to revolt, required them to dismiss the Corinthian functionaries, and to give other pledges of their fidelity. The Potidaians refused, revolted from Athens, and received aid from Corinth. The Athenians sent an expedition against them, and after defeating them in battle, laid siege to Potidaia (B.C. 432). This led to a meeting of the Peloponnesian confederacy at Sparta, in which it was declared that Athens had broken the truce, and it was resolved to take up arms against her. Thucydides dates the beginning of the war from the spring of B.C. 431. The Spartans were aided by all the Peloponnesians, except the Achaïans, and even they joined them afterwards; and except Argos, they had also the people of Megaris, Phôkia, Boiôtia, and others for their allies. The Athenians had on their side Chios and Lesbos, with Samos and other islands of the Ægean; also Plataia, most of the Akarnanians, Korkyra (Corfu), Zakynthos (Zante), and some of the Greek colonies in Asia Minor, Thrace, Macedonia, and the Hellespont. The strength of Sparta was in her troops, a large part of which consisted of the contingents of her allies. The Athenians were strong in their fleet, and they had larger pecuniary resources than the Spartans. The great Perikles died almost at the commencement of the war, in 429, of the plague. It is hard to think how greatly this blow to Athens altered her fortunes. The most stirring incident of the war is the collateral one of the ill-fated expedition to Sicily in 415 B.C. under NIKIAS—a disaster to which may be definitely traced the downfall of Athens.

The history of this long and bloody contest was written by THUCYDIDES (Thoukudidês), an Athenian, whose narrative ends in the year B.C. 411. The continuation by Xenophon is embodied in a work of his which is entitled "Hellenica."

The war was terminated by the defeat of the Athenians at Aigospotamoi on the Hellespont by Lysander (Lusandros), who sailed to Athens after his victory, and compelled it to surrender (B.C. 404) on such terms as gave the ascendancy to the oligarchical party, and thus secured to the Spartans an ally in Athens instead of an enemy.

PELOPONNESOS (Lat. *Peloponnesus*), that is, the island of Pelops, was the ancient name of the Morea. The word Peloponnesos does not occur in Homer. The original name appears to have been Apia, and it appears to have been divided into five parts, namely, Laconia, Messenia, Argolis, Achaia, and Arcadia; but in that case, as Pausanias has remarked, Elis, which for many reasons ought to be made a separate division, must have been included in Achaia or Arcadia. The ancient history of the Peloponnesos forms part of the history of Greece. The physical geography of the country is given under MOREA, ACHAIA, ARCADIA, ARGOS, ELIS, and LACONICA.

PELOPS, one of the principal figures in the Greek heroic mythology, was the son of Tantalos by Dionê, daughter of the Titan Atlas, and therefore the grandson of Zeus. Tantalos was familiar with the gods, and grew contemptuous of their wisdom. To test it he had the

barbarity to serve up as a dish at a banquet to which he had invited them, the body of his own infant son Pelops. The gods detected the horrible cheat, but the goddess Dêmêtêr, then lost in grief for the rape of Persephonê, absently ate a portion of the shoulder set before her. When therefore, at the command of Zeus, the mangled limbs were thrown together in a magic cauldron, and the boy restored to his original form, this shoulder was deficient. Dêmêtêr carved a shoulder of ivory to replace it: and all the descendants of Pelops for ever after bore, it was said, a white mark upon one shoulder distinguishing them from other men. As for the crime of Tantalos, his punishment is elsewhere described. [See TANTALOS.] On arriving at man's estate Pelops married Hippodameia, not the same princess whose marriage to Peirithôos was the occasion of the great fight between the Centaurs and the Lapiths, but a daughter of Oinomaos, king of Pisa in Elis, son of the god Arês. As an oracle had declared that the king should perish at the hands of his son-in-law, he obtained from his father Arês horses swifter than any others; and whoever came, attracted by the beauty of Hippodameia, to propose for her hand, had to contend with her father in a chariot race along the shores of the Gulf of Corinth, the wager being the princess or death. Many suitors had been outstripped and killed when Pelops came. He took a double precaution. First, he obtained from Poseidôn a pair of splendid horses; and secondly, he bribed the charioteer of Oinomaos to remove the linch-pin from the wheels of his master's chariot. Then he started, bearing Hippodameia in his chariot. Oinomaos gave him the usual start, and then lashing his horses darted off in pursuit, but his chariot soon broke down, and he was thrown out, fell on his head, and was killed. Pelops turned back with his prize, and claimed and received the sovereignty of Elis. The conduct of Pelops all through seems to modern eyes very dishonourable, for he refused to the charioteer, whose treachery had been so profitable to him, the promised reward of half the kingdom. As the charioteer threatened to betray him Pelops thrust him headlong into the sea from the cliff. Crushed upon the rocks below, he had time before the sea overwhelmed him to curse Pelops and his race. Although Pelops became master of the greater part of the peninsula of Greece, which was called after him "the island of Pelops" (Peloponnesos), and was a magnificent prince, founding (or restoring) the Olympian games with great splendour, and making them so famous that men reckoned time by those festivals, yet the curse took effect through his family. His sons Atreus and Thyestes murdered their brother, whom his father loved best; they were banished, as was but just. Hippodameia was discovered to be privy to the plot, and she too fled and died in exile. The fate of Atreus and of his son Agamemnon and his grandchildren Orestes and Iphigenia was lamentable, and the other son of Atreus, Menelaos, had an unhappy career through his wife Helena, cause of the war of Troy; while Aigisthos, the son of Thyestes (brother of Atreus), perished deservedly, but most wretchedly, by the hand of Orestes, whose father, Agamemnon, he had murdered, and whose mother, Klytëmnêstra, he had seduced. Certainly the career of several of the Pelopidai was sufficiently accursed to satisfy the vengeance of the charioteer. Pelops had great honour in ancient Greece. His temple at Olympia was renowned, and yearly sacrifices were offered to him as a demigod. Pittheus, the son of Pelops, was the grandfather of Theseus.

PELOR'IA is the term applied to the assumption by normally irregular flowers of a regular shape. Either the irregular parts of a flower are increased so that it is rendered symmetrical, or by arrest of growth the primitive regularity is retained. Examples of both kinds of Peloria occur in the toadflax (*Linaria*), the garden geraniums, nasturtiums, snapdragons, and other flowers.

PELTIER EFFECT, THE, a name given the heating of the junction of two dissimilar metals, crossed by an electric current. See THERMO-ELECTRICITY.

PELVIS. See BACKBONE.

PEMBROKE, a maritime county, forming the extreme west of South Wales, is bounded E. by the counties of Carmarthen and Cardigan, and on the other sides by St. George's and the Bristol Channels. The length from St. David's Head to the borders of Carmarthenshire is 36 miles; from Strumble Head north to St. Gowan's Head south, 31 miles. The area is 615 square miles, or 393,682 acres. In 1881 there were living in the county 91,824 persons—the males numbering 43,419, and the females 48,375.

Surface and Rivers.—The surface of Pembroke is generally undulating, with the exception of the Presaley Mountains, a range running from near St. David's Head to the borders of Carmarthenshire, which attain a height of 1751 feet above the sea.

There are a number of bays along the coast. Newport Bay is separated from Fishguard Bay by Dinas Head. Off St. David's Head lie Ramsay Island and a cluster of small islets called the Bishop and his Clerks. The coast here turns south and shortly after forms St. Bride's Bay, which is about 8 miles wide and as many in depth; off its southern point lie several small islands. MILFORD HAVEN, which is an estuary at the mouth of the Cleddau, is about 17 miles in length. The mouth is about 2 miles wide, and it varies from that width to half a mile throughout. It contains numerous bays and creeks, completely land-locked, free from shoals and rocks, with excellent anchorage in deep water, and forms one of the finest harbours in the world. The southern coast presents a wild and inhospitable appearance; the carboniferous limestone forms precipitous cliffs 150 feet high, without any good port till we reach Tenby, situated near the south-east extremity of the county. The two branches of the Cleddau are the principal rivers. The East Cleddau rises in the Presaley Mountains; the West Cleddau rises near St. Catherine's, runs by Haverfordwest, whence it is navigable for small vessels, and uniting with the East Cleddau about 5 miles below that town falls into Milford Haven. The other rivers are the Nevern, which empties itself into Newport Bay; the Gwyn, which falls into Fishguard Bay; and the Solva, which falls into St. Bride's Bay. The Teify divides Pembrokeshire from Cardiganshire.

Climate, Geology, &c.—The climate of the southern part of Pembrokeshire is mild, but the atmosphere is frequently charged with saline exhalations from the Atlantic during south-west winds, and is consequently damp. The northern part of the county is higher, and has a considerably lower temperature. If a line be drawn along the centre of Pembrokeshire east to west we find the stratified rocks north of that line composed of slates, grit, and shales; to the south the older rocks are surmounted by the Silurian formation, old red sandstone, carboniferous limestone, and coal measures. The whole surface is greatly diversified by trap-rocks bursting forth in many places, and altering the structure of the sedimentary deposits. The anthracite or stone-coal tract bisects the county; it is a continuation of the great coal-basin of South Wales, which extends over the whole coast of Carmarthen Bay. Copper ore has been found in small quantities in the neighbourhood of St. David's, but not sufficient to repay the cost of working. Slate quarries are open in the Presaley Mountains and near St. David's; the quality of the slate is inferior to that found in North Wales. A considerable quantity of good coal is also raised at Kinsmoor and Kilgetty, whence it is conveyed by a railway to the sea at Saundersfoot.

Soil, Agriculture, &c.—The geological formations of this county presenting great variety, the soil in different quarters is equally various. In the southern part the

limestone and old red sandstone formations afford soils of excellent quality. Some districts near St. David's and along the coast towards Fishguard are considered to be extremely well adapted for the growth of barley; but in the coal district and the slaty ridge of the Presaley Mountains the land is very inferior. The black cattle, which are generally known by the name of the Castle Martin breed, are bought in droves, and fattened principally for the supply of the London market. The native sheep are small, but yield excellent mutton. Their wool, which was formerly very coarse, has been much improved in some parts by judicious crossing with some English breeds. The breed of horses is much esteemed; they are rather small-sized. The fisheries are valuable. The manufactures of the county are chiefly such as are required for local purposes; but about twenty coal mines are worked, and employ a large number of persons. Lead and iron are found in small quantities, and there are some quarries of slate, black marble, and limestone. Clay for fire-bricks and sand for glass-making are also found.

Pembroke is divided into seven hundreds. It is in the diocese of St. David's, in the South Wales circuit, and the assizes are held at Haverfordwest. Under the Redistribution of Seats Act of 1885 the county returns one member to the House of Commons, and another is returned for the Pembrokeshire district of boroughs.

History and Antiquities.—Pembrokeshire anciently formed part of the territory of the Demetæ. Giraldus Cambrensis informs us that it was conquered in the reign of Henry I. by Arnulf de Montgomery (brother to the Earl of Shrewsbury), who built the first Castle of Pembroke of stakes and turf. In the same reign a colony of Flemings settled in that part of the county west of the Cleddau, who still retain their nationality completely distinct, and, curiously enough, speak English, not a Flemish dialect; and the district is hence termed "Little England beyond Wales."

Pembroke is rich in antiquities. St. David translated the archbishopric from Caerleon to Menevia (St. David's) in the sixth century, whence that town took his name.

Pembroke Castle stands on the extremity of an elevated rocky promontory. It was built in the time of Henry I.; and is of Norman architecture, with later additions. The principal tower remains perfect. During the civil wars of Charles I. this castle made a gallant defence for the crown, under Colonels Laughorne and Powell; it was taken and dismantled by Cromwell in 1648. Manorbier Castle, near Tenby, is an extensive ruin. Near St. Gowan's Head is a cell cut in the face of the steep cliff, inaccessible except by a flight of steps. Here St. Gowan lived, and is said to have performed miraculous cures. Cilgerran Castle, on the Teify, was built by Marshall, earl of Strigal (Chepstow), after he had conquered Gryffydd, prince of Wales, in 1223. Picton Castle, at the confluence of the two Cleddaus, was built in the reign of William Rufus. Near Pentre-Evan lies a very large cromlech. There are several other Druidical remains in the neighbourhood. The church of Nevern is a very venerable pile, and one of the largest in the county. Besides the remains above enumerated are the castles of Carew, Narberth, Haverfordwest, Banton, Newport, Roch, Tenby, and others.

PEMBROKE (from the Cynric *pen* and *bro*, head of the district), a market-town and parliamentary municipal borough, lies in a rich country on a navigable creek of Milford Haven, 10 miles S. by E. from Haverfordwest, and 284 from London by the Great Western and Pembroke and Tenby railways. The town consists chiefly of one long street, gradually ascending to the castle, which is situated on an abrupt rocky promontory at the west end. Of late years many new houses have been erected, but they are chiefly small. Pembroke is the head of a parliamentary district, with a population of 34,795, which

returns one member to the House of Commons under the Redistribution of Seats Act of 1855. The municipal borough is divided into two wards, and governed by six aldermen and eighteen councillors. The population in 1881 was 14,156. About 2 miles from Pembroke, on the shore of Milford Haven, is situated Pater, or Peinbroke dock, the naval dockyard and arsenal, which was removed hither from Milford in 1814. Very great improvements and additions have been made in the dockyard, and a line of fortifications erected around the town at a cost of £250,000. There is a modern church, and a Congregational chapel was built in 1868. The castle, where Henry VII. was born in 1457, and which Cromwell captured in 1648, after a six weeks' siege, is of great antiquity, dating from 1002. The keep is 75 feet high, 163 feet in circumference, and surmounted by a conical roof of stone. St. Michael's Church is a good Norman building.

PEMBROKE COLLEGE, Cambridge, formerly called *Penbrooke Hall*, was founded under the name of Valence-Mary by Mary de St. Paul, the widow of Aymer de Valence, earl of Pembroke, in 1347, when she endowed it with estates for the maintenance of a master, six fellows, and two scholars. The foundress was maid, wife, and widow all in one day, her husband having been slain in a tilting match held in honour of the nuptials. After this she sequestered herself from the world, and devoted her fortune to pious uses. King Henry VI. is said to have trebled the revenues of the college by bestowing upon it the priory of Linton, with its appurtenances, and the rectory and manor of Soham. There are thirteen fellowships open to graduates of Cambridge or of Oxford, one being a professorial fellowship. A fellow vacates his fellowship on presentation to a college benefice worth £400, or after six years from his election, unless he holds (or has held) certain college or university offices. The emoluments do not exceed £250, exclusive of rooms and commons. There are twenty-nine open foundation scholarships; three of £80 a year, nine of £60, eight of £40, and nine of £20; and a further scholarship of £60, with a preference to candidates who have been two years at the Free School of Bowes in Yorkshire.

Pembroke College is situated on the east side of Trumpington Street. It was much transformed in 1873-77, under the direction of Mr. Waterhouse. The famous old hall was demolished and a new one erected in its stead. The whole aspect of the great quadrangle was changed. One side was rebuilt in red brick and stone, and a new library occupies the other. The chapel of Pembroke College was built by Matthew Wren, bishop of Ely, after a design of his nephew Sir Christopher Wren.

PEMBROKE COLLEGE, Oxford, was founded in the early part of the seventeenth century, on the site of Broadgate Hall, an ancient seminary for students of the civil and canon law. It was long known by the name of Segrin Hall, or corruptly, Segreve Hall, but afterwards received the title of Broadgate Hall. It was one of the purchases which Wolsey attached to his intended college, and at the dissolution was confirmed to Christ Church by King Henry VIII. Dr. John Budden, the last principal of Broadgate Hall, died in 1620. The new foundation took place a few years after this in consequence of a bequest of £5000 from Thomas Tesdale, of Glympton in Oxfordshire, assisted by a second benefactor, Richard Wightwick, B.D., sometime of Balliol College, and afterwards rector of Ilsley in Berkshire, who engaged to make over some estates in aid of the endowment. Pembroke College was established by letters patent, 22nd June, 1624, with the designation of "The Master, Fellows, and Scholars of the College of Pembroke, in the University of Oxford, of the foundation of King James, at the cost and charge of Thomas Tesdale and Richard Wightwick." It received the name of Pembroke from William Herbert, earl of Pem-

broke, then chancellor of the university, whose interest was liberally employed in its establishment. It then consisted of ten fellows and ten scholars, besides the master; and ten fellowships and six scholarships were afterwards added by different benefactors. Several unincorporated scholarships and exhibitions have also been added at different times.

The constitution of the college was altered by an ordinance of the commissioners acting under the statute 17 & 18 Viet. c. 81, and it now consists of a master, not less than ten fellows, and twelve incorporated scholars. The fellowships are open to all who shall have passed the examinations required by the university for the degree of Bachelor of Arts. Of the incorporated scholarships five at least are to be called Abingdon Scholarships, to be filled up by persons educated at Abingdon School; two are to be called King Charles I.'s Scholarships, and are to be filled by persons born in Jersey, Guernsey, or the adjacent islands, or educated for two years in Victoria College, Jersey, or Elizabeth College, Guernsey. The other incorporated scholarships are perfectly open. The incorporated scholarships are to receive not less than £50 a year, and to enjoy rooms rent free. In addition to the incorporated scholarships there are eleven unincorporated, and subject to various conditions. The college presents to eight benefices, and Queen Anne annexed a canonry of Gloucester to the mastership for ever. The greater portion of the buildings of Pembroke College are of a date subsequent to the foundation. The hall was built in 1848.

PEM'MICAN or **PEM'TCAN**, a kind of preserved meat originally prepared by the North American Indians, and afterwards by the trappers and hunters of North America, consisting of the lean of venison or buffalo flesh dried in the sun, pounded into a kind of paste, and pressed into cakes or packed in dried bladders for keeping. It will keep for a very long time unimpaired, and it was formerly supposed to be very nutritious. It was introduced into the British navy by Captain Parry, for use in his first arctic expedition, but with the difference that beef was substituted for venison, and the meat, after being dried over a wood fire, was packed with nearly an equal weight of melted fat in hermetically sealed vessels. Experience has proved that as an article of food pemmican has but little value, and other methods of preserving are preferred by modern explorers.

PEM'PHIGUS or **POM'PHOLYX**, a somewhat rare skin disease, which is marked by the eruption of large blebs or bullæ containing serous fluid on the body and limbs, which burst, dry up, and are succeeded by large brown crusts, which fall in about three weeks, leaving temporary stains but no permanent scars. It is more common in children than in adults, and most frequent in the first eighteen months of life. Its causes are somewhat obscure, and neither geographical distribution, season of the year, nor any special diet or habits of life, seem to affect its development, while it occurs in persons of all temperaments, and in the healthy as well as the delicate. It is non-contagious, and though experiments have been made by inoculating with the contents of the bullæ, they have all failed to convey the disease. The disease occurs in many different forms and degrees of intensity, varying from a few bullæ, which in no way affect the general health and soon disappear, up to a malignant form of eruption, which spreads over the whole body and is always fatal. It is impossible to indicate any line of treatment suitable to all cases of this disease, but most acute cases are best treated by cooling medicines, good diet, and soothing local dressings; while in chronic cases the treatment which commands most general approval consists in the administration of tonics, especially quinine or bark and iron, and in supporting the strength of the patient by nourishing food and wine. The only drug which appears to have any special power over this disease is arsenic, which in many cases has proved to be of great

service, but which is not a true specific, for in some instances it fails to exert a beneficial influence. Local treatment consists in puncturing the fully formed bubble, and then in coating the parts with zinc, lead, or boracic acid ointment, or else in dusting them with the oxide of zinc or starch.

PEN. An instrument for writing with an ink or coloured fluid. The earliest implement for writing appears to have been the graver or style, by means of which lines were scratched upon hard surfaces, or upon tables coated with wax, and when skins and parchment came into use the letters were at first painted with a hair pencil brought to a fine point, similar to that used by the Chinese at the present day. Afterwards the reed pen was introduced, at first simply cut to a point, but soon improved by slitting, so as to form a nib. There are several references to pens of this kind in the Bible, and in Jeremiah xxxvi. 23 we have a reference to a peculiar kind of knife designed for the shaping of the reed pens. Reeds and hollow canes are still used by the Turks, Syrians, Persians, Arabs, and other Orientals, and their written characters are more easily formed with pens of this description than with the pens most in use in the West. The use of the quills of large birds was of later introduction, and the earliest specific allusion to the quill pen known occurs in a work written by St. Isidore of Seville in the early part of the seventh century. Once introduced they soon in Europe superseded all earlier forms, and quill pens remained the chief writing implements among civilized communities until nearly the middle of the present century. Those most in use were such as were obtained from the wings of the goose, though swan quills were highly prized on account of their superior size and strength, and crow quills were valued for fine writing and drawing. Even at the present day immense quantities of quills are cut into pens, and they are preferred by some even to the most improved form of steel pen. A metallic pen, in the form of a cylinder of thin steel, shaped and pointed at the end like an ordinary quill, was made and sold in London by a Mr. Wise as early as 1803, but as it was hard, scratchy, and sold at 5s. it failed to obtain public approval. A metallic pen of a somewhat different form was patented by a Mr. Bryan Donkin in 1808; but it was not until 1820 that steel pens became of any commercial importance, and then they owed their improvement to Mr. Joseph Gillott, who hit upon the plan of giving the nibs three slits instead of one, so as to make them softer and more flexible. Mr. Gillott also introduced machinery into the manufacture of steel pens, and was thus enabled to sell them at the rate of a penny each, which was regarded at the time as a wonderful success. Further improvements were introduced into the manufacture by Joseph Perry, Josiah Mason, and others, and by the year 1850 it had become an important branch of the trade of Birmingham. This town still retains a practical monopoly of the manufacture of pens, now being made anywhere else in the United Kingdom; and though they are made in France, Germany, and the United States, the manufacture is on a comparatively unimportant scale.

The machinery used in the manufacture of steel pens is very skillfully designed for the purpose required, and pen-makers can now produce pens for a few pence per gross far superior in all respects to those sold in the early part of the century at 5s. each. The following is an outline of the process generally followed in the manufacture of the ordinary steel pen:—The metal used consists of rolled sheet. A cast steel of the finest quality, made from Swedish charcoal iron, and it is delivered to the manufacturer in ribbons of about 3 feet in length and of such a breadth that the blanks may be cut out with as little waste as is possible. These strips or ribbons are then annealed in a muffle furnace and steeped in dilute sulphuric acid to remove the oxidized scale from the surface, after which they

are passed between steel rollers until they have assumed the thickness of the pens required. The "blanks" or pieces which form the pens are then cut out, and by another operation the shoulder slits and central perforation are secured, after which they are annealed in a muffle furnace. After annealing they are stamped with the maker's name, trade mark, &c., and then the flat blanks are rounded into the semi-cylindrical form in which pens are used. The next process consists in *hardening*, which is effected by heating the pens in a muffle, plunging them in oil, and heating them over a fire until they attain the dull blue colour characteristic of spring-steel elasticity. After this tempering they are scoured by being placed in a cylinder with sand, emery powder, pounded crucibles or such like substances, and the cylinder is then kept revolving by machinery until the pens are brightened and show the natural colour of the metal. The grinding of the points on small rapidly revolving emery wheels follows, the points being first ground lengthwise and then across the nib in order to increase the elasticity of the point, and then, and not till then, is the central slit made, upon which depends the perfection of the pen as a writing implement. This important operation is effected by a hand screw-press fitted with a cutting part, consisting of two chisels, one fixed on the table, and one coming down on the depression of the lever so as just to clear the other. This operation is performed with wonderful rapidity, and a good workwoman can slit 28,000 nibs in a day. The finishing process consists in the colouring of the pens, which is effected by heating them in a revolving cylinder placed over a charcoal fire, after which they may be varnished with lac dissolved in naphtha. Gold pens, which are incorrodible by ink and possess a fine quill-like flexibility, form a special industry, and require processes and machines of a very different kind to those used in the steel-pen industry. The first successful makers of gold pens were Messrs. Mordan of London, but the business is now chiefly carried on in the United States, the value of the gold pens and pencils manufactured there being over \$2,000,000 a year. The points of the gold pens are fitted with small morsels of a native alloy of osmium and iridium, of such extreme hardness that it will resist constant wear for many years.

PEN, ELECTRIC. This is an invention of Mr. Edison for producing a stencil, whereby any number of copies of a given document can be produced by an inked roller. A small battery is connected by a flexible cord to a tiny electro-magnetic engine, which surmounts a sheath made to be held in the hand like a pen, the cord being made of the insulated wires from the two poles of the battery. The pen, with the little engine at its top, is held perpendicularly to the paper, and moved as usual in writing. Through the sheath darts a sharp pointer, thrust forward and drawn back with great rapidity by the electro-magnetic engine, and as the point of the pen moves over the paper, its tract is consequently covered by a series of fine holes close together, forming a stencil, through which printers' ink can readily pass to produce copies.

PEN PITS. At Penselwood in Somerset, 3 miles from the Wincanton station of the London and South-western Railway, there are an immense number of curious pits honeycombing the ground. These, while varying very greatly in their dimensions, resemble one another alike in their circular form, their average depth (of from 10 feet to 15 feet), and the "party walls" surrounding them, upon the top of which is still the only path the pedestrian can use in threading his way through the somewhat bewildering maze. At the present time these pits occupy a space of considerably less than a square mile, although fifty years ago they covered at least 700 acres, and the number of the cavities exceeded 20,000. Their object has long been a puzzle to archaeologists, but the most probable explanation seems to be that they are the pit-dwellings of a very

early British city. This hypothesis is confirmed not only by the numerous remains of strong fortifications, evidently designed to defend some important station, and by the hill forts by which the approach from the sea along the Stour is at so many points protected, but also by the circumstance that the name Penselwood points to its identification with the British town named in the Neuman catalogue as *Caer Pennelcoit* (*coit* being equivalent to wood). It is stated in the British "Chronicle of the Kings" that Vespasian, having landed somewhere on the south coast, marched directly to besiege this town; that after seven days, Grywydd, a British leader, overtook him and commenced a bloody but unsuccessful battle; that at last, being overcome by the superior numbers of the Roman army, he had to agree to a peace; and that finally, the Southern Britons being thus subjugated, Vespasian once more returned to Rome.

PENÆA'CEÆ is a small South African order of plants belonging to the group *MONOCOTYLEDONÆE*. They are ever-green shrubs with small opposite, entire, castipulate leaves. The flowers are solitary in the axils of the upper leaves or of coloured bracts. The perianth is coloured, tubular, with a four-lobed limb; the stamens are four, inserted in the throat of the perianth, and alternating with its lobes; the ovary is superior, four-celled, with either four stigmas or one four-lobed; the fruit is a four-celled, four-valved capsule. About twenty species have been described, of no known importance; some produce a nauseous viscid gum, which has been called *sarcocoll*, but is not that so called by the Greeks.

PEN'AL SERVITUDE. See PRISON and PRISON DISCIPLINE.

PEN'ALTY, in its original and proper sense, is a pecuniary punishment imposed by statute upon parties guilty of certain offences. Where a sum of money is reserved on an agreement, to be paid in case of the non-performance of such agreement, it is generally (though not always) to be considered as a penalty, the legal operation of which is, not to create a forfeiture of the entire sum, but only sufficient to cover the actual damages occasioned by the breach of contract. In general, any one who fails to perform any act to which he has become bound, is liable in damage to the person injured by his breach of agreement. Statutory penalties are such as are declared to follow on certain illegal acts, and it is usual for the Acts of Parliament which impose penalties to fix a maximum sum, leaving to the courts empowered to enforce them the power to impose a lesser sum at discretion. In some cases penalties can only be sued for by the persons directly injured; in others the privilege of suing for the recovery of the penalty is restricted to the crown, but as a general rule statutory penalties can be sued for by any one, and in many instances persons are encouraged to set the law in motion by an award of the whole or part of the penalty imposed. Such persons are legally termed *common informers*, to distinguish them from persons specially damaged by the acts complained of.

PEN'ANCE (Lat. *penitentia*) is a censure or punishment imposed by the ecclesiastical law for the purgation or correction of the soul of an offender in consequence of some crime of spiritual cognizance committed by him. Among the Jews at the period of the foundation of Christianity, persons who committed public offences against the religious law were punished by exclusion from the synagogues, by being deprived of ordinary intercourse with their brethren, or in extreme cases, by complete expulsion from all fellowship in Israel. Soon after the Christian church was formed the necessity for discipline became apparent, and in Matt. xviii. 17, 18; xvi. 19; John xx. 23, &c., we have references to the power of the church (or congregation) to judge between brethren, to the apostolic authority of binding and loosing, and in the first passage there is a reference to excommunication in the event of

contumacy on the part of an offender. That the apostles exercised disciplinary powers in the church is evident from the commands of St. Paul in respect to the incestuous member of the church at Corinth (1 Cor. v.; 2 Cor. ii.), and it is tolerably certain that the rules and methods of the apostles formed the foundation of those which afterwards prevailed in the primitive church. At first only gross and scandalous offences were taken notice of, and the penalty enforced was that of excommunication, which it was believed placed the offender under the dominion of Satan, and such persons, though not cut off from all hope, could only return by the way of public confession, submission to the authority of the church, and the performance of certain outward and visible acts significant of the implied inward change of heart and mind. During the first centuries, when the church was the subject of repeated persecutions, it was found that many persons relapsed during the time of trial, but who were anxious to recover their positions in the church when the wave of persecution had spent its force. Among the faithful there were some stern and rigid brethren who were inclined to exclude such offenders for ever, but the majority were content to re-admit the lapsed brethren, provided they complied with the discipline required of all penitents seeking re-admission. After a time definite rules for dealing with such cases were laid down, and by the fourth century certain grades of penance had become established as part of the regular discipline of the church. The period of probation, which in the earliest times had been comparatively brief, was protracted to terms of ten, fifteen, or twenty years, or even until the hour of death, and the penitents were divided into four classes: (1) Weepers, who were forbidden to enter any church during public worship, but who might stand at the door and ask the prayers of the faithful; (2) Hearers, who were permitted to enter and remain during the reading of the lessons, and the performance of the minor offices, but who were compelled to depart before the commencement of the eucharistic office began; (3) Kneelers or Prostrators, who might remain during the opening portion of the eucharistic service, but who had to retire with the catechumens before the more solemn portion commenced; and (4) Standers, who might remain standing through the whole service, but who were not permitted to communicate or mingle their oblations with those of the faithful. All grades were required to wear a distinguishing dress, and to practise numerous austerities and works of charity and mercy. At first all cases of penitence came under the personal attention of the bishop, but the numerous lapses during the Decian persecution (250 A.D.) led to the appointment of special penitentiary priests, who were commissioned to hear the confessions of the penitents, and to assign them the necessary penance. This office was abolished in the Eastern Church by the Patriarch of Constantinople about 390, but it has ever since been retained in a modified form in the West. At first public discipline formed an essential part of penance, and this continued to be the case for several centuries, but ultimately a distinction was drawn between such sins as were publicly and privately committed, private penance being permitted in the latter case. With this innovation the field covered by penance was widened and extended until it was made to apply to all sins, even the most secret, and about the same period the practice of accepting a money payment or fine in lieu of personal suffering or devotion was introduced. As may be supposed the latter practice proved very profitable to the clergy, and that it led to grave abuses is abundantly proved by the numerous attempts that were made to regulate it during the latter half of the mediæval period. The evil perhaps reached its height during the closing years of the fifteenth and the opening years of the sixteenth centuries, but this has been already noticed under INDULGENCE and LUTHER. After the Reformation the doctrines relating

to penance and the practices to be observed were defined and appointed on mediæval lines by the Council of Trent for the Roman Catholic Church, while among the Reformers some attempts were made to revive the usage of the primitive church. In the Lutheran communion it was at first intended to retain the practice of penance, but it failed to obtain general recognition and support, and though confession and absolution are still retained in the Lutheran system they are not associated with any regular discipline. The Calvinists, on the other hand, endeavoured from the first to enforce a very strict discipline in the churches, and both the Scottish Reformers and English Puritans required open offenders to submit to numerous public humiliations upon penalty of exclusion from church membership altogether. In Scotland the "First and Second Books of Discipline," published by Knox, lay down with much precision the principles for dealing with offenders against religion, and some of the penalties enforced are of a very severe character. After a time, however, the stringency of the law was relaxed, the power of the purse making itself felt here as elsewhere, and a fine to the poor of the parish was substituted for public confession and submission to rebuke.

With respect to the theological aspect of penance, it may be observed that it forms one of the seven sacraments of the Roman Catholic Church. All mortal sins committed subsequent to baptism require the sacrament of penance for their remission, and the latter includes contrition, confession, and satisfaction on the part of the penitent, such acts being termed its *matter*, the *form* of the sacrament being the absolution pronounced by the priest. In ordinary language the acts of bodily or spiritual mortification which make up the satisfaction demanded of the penitent are termed penances. Protestants for the most part reject wholly the doctrine of the Roman Catholic Church upon this subject, and contend that it is without due foundation in Scripture, and opposed to the great fundamental doctrine of justification by faith. It is admitted that disciplinary observances may be useful as a means of warning to the sinner and to others, but most Protestant divines insist strongly upon the powerlessness of a sinner to make any addition to the complete and finished atonement of Christ, or to obtain any *merit* of his own that shall plead for pardon. The controversy relating to this subject is very voluminous and extensive, and references to it will be found in all the more important treatises which have been composed for polemical purposes by the divines of both sides.

PENANG, PULO (or *Prince of Wales Island*), an island belonging to Great Britain, in the Strait of Malacca, extending from south to north about 15 miles, with an average breadth of 8 or 9 miles, which gives a surface of 107 square miles.

Wellesley Province lies opposite Pulo Penang on the Malay Peninsula, and is separated from the island by a strait. It consists of a strip of country 35 miles in length by 4 miles in breadth. The principal products are rice, pepper, sugar, and cocoa-nuts, with poultry and cattle, which it supplies to Penang.

The surface of the latter island is densely wooded and highly picturesque; mountains in the north, where the hills rise to nearly 3000 feet; elsewhere it is level or undulating. The thermometer ranges from 76° to 90°, and the climate is considered enervating. The island is well watered, and the soil is admirably adapted for raising spices. The native name of the island signifies "betel-nut," which is one of the principal productions; it also produces pepper, cloves, nutmegs, araca, gambier, and ginger. Since palm-oil has been extensively used in the manufacture of candles in England, the plantations of cocoa-nut trees have greatly increased. Sugar, sago, tapioca, &c., are also grown for export, and the trade of

the island with Sumatra is now very extensive. Rice and Indian corn are the only kinds of grain cultivated. Fruit, vegetables, and timber trees grow in great variety and abundance. Buffaloes and cattle are rather numerous. Poultry is plentiful. Wild animals of the largest size are found in Wellesley Province, as the elephant, rhinoceros, and tiger. The interior is abundantly supplied with birds, and the sea-coast with fish. Tin ore is found at the base of the mountains.

When the English took possession of Penang Island, in 1786, they found only a few Malay families, mostly fishermen; but natives from the neighbouring countries, as well as Chinese, and Chuliahs from Hindustan, soon flocked to it, and the population is now about 75,000. The inhabitants consist chiefly of Malays; next to these in number are the Chinese. The Europeans are gradually increasing. Georgetown, on the north-eastern extremity, is the capital.

Before 1786 the island and province belonged to the small kingdom of Keddah. At that time the British desired a good harbour in those parts. Penang was found fit for that purpose, and it happened to be the property of an Englishman, Captain Francis Light, who had received it from the King of Keddah as a marriage portion with his daughter. Captain Light transferred his property to the late East India Company, and was appointed first governor of the island. The company afterwards obtained the coast district of Wellesley Province, by agreeing to pay 6000 Spanish dollars to the King of Keddah for the sovereignty of the island, and increasing the payment to 10,000 dollars on the cession of Wellesley Province.

Penang is now under the control of the British Colonial Office, and with Wellesley Province, Malacca, and Singapore, forms the STRAITS SETTLEMENTS, the seat of government of which is on the last-named island.

PENANG LAWYERS, the commercial name given to walking sticks made from the stems of a species of palm, *Licuala acutifolia*, imported from Penang.

PENARTH BEDS, a geological formation, more generally known as the RHETIC. In England these beds were originally so called by the Geological Survey, from their extensive development at Penarth, near Cardiff, but the name is now rarely employed.

PENATES (from the Latin), the household gods of the ancient Italians, who presided over the fortunes of families, and were worshipped at the domestic hearth. The term is connected with *penus*, a store of food, which, as well as the household images, was kept in the *penetralia*, or innermost part of the dwelling-house. The Penates included the Lares (that is, the one Lar of each family), and the two are usually mentioned in conjunction. Vesta was the chief of the Penates, the goddess of the hearth-fire, symbol of the sacredness and purity of home. But the names of the other Penates were never divulged. The hearth-fire and the dining-table were looked on as perpetual sacrifices to them, and many small objects were associated with them as symbols. Everyone on returning home saluted the Penates as part of the family, and prayed for their protection on going abroad. All this points to a kind of prehistoric fetish worship, the features of which have become so blurred by time as to be unrecognizable.

PENCIL, a term of optics, and sometimes of geometry. A pencil of rays is a collection of rays which converge to or diverge from the same point; and a pencil of lines is a number of lines which meet in one point.

PENCILS. This name is applied to the small brushes used by artists, to the plumbago crayons commonly termed blacklead pencils, to crayons of chalk inclosed in wood, and to strips of slate used for writing on slate.

Hair pencils, used for painting or writing with fluid colours, have been employed from a very remote period, and there is historical evidence to prove that they were used by the Greek painters as early as the fourth century

1800. At the present day they are manufactured from the hairs of the camel, badger, fitch, sable, goat, and the bristles of hogs, and of swan's down. The larger brushes are sometimes set in a tin tube, and the smaller ones are set in quills of different sizes, which are then usually secured to a wooden handle.

The chief element in the *blacklead pencil* is graphite or plumbago, and the term *lead* is misleading, inasmuch as graphite consists almost entirely of carbon, and has no lead whatever in its composition. Previous to its introduction, in the sixteenth century, styles formed of lead and tin were used for drawing lines upon paper, and when the new material was observed to make much clearer and darker lines, it was probably termed *black lead* to distinguish it from the old composition. It was owing to the discovery of the famous Borrowdale mine in Cumberland that blacklead pencils came generally into use, and while the supply from that source lasted, the best pencils were made by cutting the blocks of graphite into thin plates with a saw and again into strips as wide as the plate was thick; but in the year 1795 a Frenchman named Conté devised a process by which small fragments of dust and cuttings could be utilized for making pencils of very excellent quality. This was used concurrently with the first-mentioned process for a long period, and now that the supply of the Borrowdale mines has become exhausted it has almost entirely superseded it. In this process the graphite, after being reduced to powder in a mortar, is calcined at a bright red heat, and then mixed with water in a vat and left for a time to settle. As soon as the heaviest particles have been deposited, the water is allowed to pass into a second vat for a further settlement, and the process is repeated a third time in order to secure the finest particles for pencils of the best quality. A quantity of clay, which has been carefully freed from sand and iron, is treated in a similar way, and the two materials are mixed in varying proportions, thoroughly incorporated, and ground together until they form a homogeneous mass which has the consistency of stiff dough. The material thus prepared may then be pressed into grooves cut on the face of a smooth board, or into well-greased wooden moulds, in which state it is left to dry. When dry the pieces are tempered to any degree of hardness by exposing them, surrounded by sand or powdered charcoal, in a closely covered crucible to various degrees of heat. Another method of preparing the strips after the material has been brought into the form of paste, is to place it in a brass cylinder and to force it by the steady pressure of a piston through a perforated bronze plate, the threads thus obtained being received upon wood and left to dry, before being tempered in the crucible. The two elements which regulate the hardness and blackness of pencils are the proportions of plumbago and clay in the mixture, and the temperature to which the dried strips are raised in the crucible. Another method of preparing powdered plumbago for pencils, invented by Mr. Brockedon of London, and patented in 1843, consisted in submitting the material to powerful hydraulic pressure after having, by an ingenious method, extracted the air from the interstices by means of the air-pump. By this process blocks of graphite are obtained which may be sawn and cut in the same way as the natural mineral, but though mechanically successful it has failed to take the place of the Conté method. Coarse pencils for carpenters' use are made by melting up a mixture of sulphur and graphite with a little tallow to give softness, and running the composition into moulds.

The wood employed to form cases for the lead generally consists of pencil cedar (*Juniperus virginiana*). This is cut into rectangular strips of unequal thickness, and in the thick strips grooves are cut by means of a circular saw; into these grooves the strips of lead are placed and the thinner pieces of wood are then glued down over them. The pencils are then passed through a rounding machine,

which leaves them cylindrical in shape and perfectly smooth, and after they have been stamped with their grade and the maker's name they are ready for use. Sometimes the pencils are polished, varnished, and stamped with gilt letters after they have passed the rounding machine, but pencils of the best quality are generally left plain. The letters stamped upon pencils to signify their peculiar quality are H, signifying hard; IIII, harder; IIIH, very hard; B, black; HB, blacker; and HBB, very black. The sign HB signifies hard and black, and the sign F is sometimes used in addition to indicate fineness of stroke.

Coloured or chalk pencils are prepared by mixing clay, the colouring mineral, and a certain proportion of wax and tallow, by a process resembling the Conté method for graphite, already described, but the compositions are not tempered in a crucible, as the heat would destroy the colour. The *ever-pointed pencil* is an instrument for employing cylindrical pieces of black-lead, which are forced forward in the pencil just so far as to allow them to be used without breaking. The leads are manufactured of different thicknesses, and the pencil cases are marked with a letter to correspond with the lead required for it. *Copying or indelible pencils* are prepared from an admixture of an aniline preparation with finely divided clay. *Slate pencils* are merely strips of soft slate cut into short lengths and rounded. The so-called *metallic pencils* used for writing upon asses' skin or prepared paper are made from "fusible metal"—an alloy of bismuth, lead, and tin.

PEN'DA ("the Strenuous"), a very famous heathen king of Mercia in the Old English times, and the fiercest foe of Christianity in these islands, succeeded Ceol his father in 626. He first measured his strength against Cynegils, king of Wessex, in an indecisive campaign ending with a drawn battle at Cirencester in 628. Mercia was at this time under the overlordship of Northumbria, and when the great Eadwine (founder of Edinburgh, i.e. Eadwinesburgh, his northern capital) embraced Christianity, and much murmuring arose among those who were disinclined to change from the faith of their fathers, Penda thought he saw a chance of shaking off the hated supremacy, and striking a blow at the same time at the new-fangled religion. He made an alliance with Cadwallon, therefore, one of the chief kings of the British (Welsh), and this was the first friendly communication between Teuton and Celt since the English conquest. These strange allies, only united by a common hatred of Eadwine and his new faith, suddenly attacked Northumbria, and on Eadwine's hurrying forward to meet them, he was slain in the battle of Heathfield Chase (14th October, 633). In those days the fall of the leader meant nearly always the discouragement and break up of the army; and not only was it so in this case, but a disputed succession in Northumbria left the splendid kingdom still more at Penda's mercy. The British priests fled for their lives. Penda left Cadwallon to guard Northumbria, while he consolidated his conquests, and gathering a province here and a province there he extended his little kingdom of the upper Trent into a great dominion covering all middle England south of the Humber and west of the Severn. Meanwhile Oswald, nephew of Eadwine, collected a small force, increased it by degrees, and at length was strong enough to fall on Cadwallon at Heavenfield and utterly defeat him, breaking for ever such power as the British still had. Oswald was a Christian, though of the Irish and not of the Roman Church, and was so fervent in his faith that he gained the honours of canonization. He soon restored the supremacy of Northumbria, and was to the full as powerful a prince as Eadwine before him, asserting his overlordship even over Wessex and East Anglia.

Penda felt his own turn would come next, and during the long interval since Heathfield he had consolidated his power. His first move was not against Northumbria

direct, but against East Anglia, where a monk ruled as king who would bear no weapon to battle but the cross. Penda had an easy victory over such a foe, and speedily overran East Anglia. Oswald, as he expected, soon arrived from Northumbria to assert his supremacy, but Penda had succeeded in drawing him off his ground, and was rewarded for his strategy by the complete victory of Masefield, 5th August, 632.

Penda was now Bretwalda or overlord of Britain, undisputedly supreme. Wessex at once acknowledged his suzerainty, and Northumbria also. Rising after rising among the royal people, however, stirred Penda's wrath, and were followed by ravage after ravage at the hands of the fierce heathen. When the Castle of Bamborough resisted him he pulled down the cottages near, and with them lit fires beside the castle walls which soon laid them in ruins. Nevertheless, though he quelled the people he could not cow them; they refused to abandon the Cross, and even his own son, whom he set as governor over part of his new territory, was baptized at the hands of his subjects. The fearless missionaries penetrated into Mercia itself, and Penda, who had gained much of the royal spirit by his great elevation, now let them alone. He himself still stood aloof, and often mocked the converts as not being much the better men for all their high professions. But Oswi, a cousin of Eadwine, had meanwhile succeeded to the throne of Northumbria, and had steadily and rapidly gained strength. Penda roused himself at last at the sense of danger, and led a fine army into the land he had so harried ten years before. Oswi offered large ransom if he would retire, but Penda refused the rich gifts. Then the Northumbrians dedicated them all to God, and with a brave heart awaited the heathen charge. They considered that it was in consequence of their church gift that the river swelled high, so that in the course of the battle the Mercians were pined in, unable to escape, and perished almost to a man. This was the fight of Winwood Field, near Leeds (655). Mercia never again had a chance for supremacy, and heathendom had struck its last heavy blow and fell with Penda on the field. Mercia owned Oswi's overlordship; Wulfere, a son of Penda, was its king, after two or three years of attempt on Oswi's part to rule Mercia himself.

PEN'DANT (Lat. *pendero*, I hang), in Gothic architecture, is an ornamental mass of stone hanging down or descending from the intersections of a groined vaulting. Pendants no doubt originated in bosses, of which they may be considered an enlargement, and may be described as being formed by the revolution of a corbel or a bracket. Excellent examples are shown in Plate IV., illustrating English Cathedral Architecture (Henry VII.'s Chapel).

PEN'DLETON, a township in the county of Lancaster, and a suburb of Manchester, on the main road to Bolton, with a station on the Lancashire and Yorkshire Railway, 191 miles from London. The inhabitants are principally engaged in manufactures of cotton, calico, and silk, and in collieries. The town is also the residence of a large number of the merchants of Manchester.

PEN'DULUM (Latin *pendero*, I hang), anything freely hanging from a point of suspension, as a plum-bob for instance, the word covering both the bob or weight and the rod or string by which it is suspended. The laws of the pendulum when it is set swinging are (subject to practical deductions of slight amount)—(1) all the swings will be in equal times, the long swings by very rapid motion getting accomplished in the same time as the slow short swings when the pendulum is almost at rest; hence the great value of the pendulum as a timekeeper; (2) the pace and time are independent of the weight of the bob, (3) but vary direct as the square roots of the lengths of the rods or suspending strings, (4) and inversely as the square root of the force of gravity at various latitudes. Consequently the length of the seconds pendulum (*i.e.* a pendulum oscil-

lating once in a second) varies for different places. Its length at London is 39.139 inches, and 39.017 at the equator. By the third law a pendulum oscillating twice in a second is a quarter this length, and so on.

Compound Pendulums.—These are the ordinary pendulums, when the bob is of considerable size and the suspending rod or cord is of some stoutness. The simple or theoretical pendulum is that in which the thread is so fine as to be left out of account and the bob is small. In compound pendulums the measurements and calculations depend upon the centre of oscillation of the whole mass, by no means the same with the centre of gravity. The point of suspension and the centre of oscillation are mutually convertible without altering the behaviour of the pendulum. [See OSCILLATION, CENTRE OF.] Such a pendulum will move the same as a simple pendulum of the length of the distance of its centre of oscillation from its point of suspension, called the *simple equivalent pendulum*. For instance, a stout wire will oscillate in about the same time as a simple pendulum of two-thirds its length.

Compensating Pendulum.—But since, by law 3, pendulums vary in time of oscillation directly as their length, and since heat makes all substances expand, it follows that pendulums must beat slower in summer than they do in winter. This is the case, and the irregularity in clocks with ordinary pendulums is consequently very great. To obviate this various forms of compensating pendulum have been invented. The principle of all of these is, that the expansion of the pendulum away from the centre of suspension should be counteracted by an expansion towards that centre. The simplest form is that known as the gridiron-pendulum. The plan of this is very ingenious; it depends on the fact that brass expands more than steel. The rod, descending from *o*, the point of suspension, to *l*, where the great circular ball or bob is attached, is interrupted by a frame thus composed:—First, a complete rectangle of steel, *A B, A B*, hangs from the rod; *D C, D C*, which is a figure like the Greek letter Π , made of brass, stands on the base of this steel rectangle; from the horizontal brass bar, *D D*, hangs a like figure, *E F, E F*, but of steel, and inverted; upon the horizontal steel bar of this, *E F*, stands a like figure of brass, erect, *H I, H I*; and from the brass horizontal bar, *H H*, of this figure hangs the rod which carries the bob. A moment's consideration will show that the "gridiron" can easily be so adjusted as that the expansion of the steel downwards shall be exactly neutralized by that of the brass upwards, and that consequently the length of the pendulum (*i.e.* that of the *simple equivalent pendulum*) never varies, whatever be the variation in heat, and consequently in expansion. The sum of the lengths of the vertical steel rods will, of course, have to be to the sum of the lengths of the vertical brass rods in the inverse ratio of the coefficients of expansion of steel and brass, that is, about as 9 to 5.

Graham's mercurial pendulum is that usually seen in clockmakers' "regulators." Here the rod of the pendulum



is steel, and the bob a hollow glass cylinder, containing a considerable quantity of mercury. As the mercury naturally expands upwards it neutralizes the downward expansion of the rod. This kind of pendulum is remarkably capable of the most delicate adjustment.

Martin's pendulum carries a transverse rod, A, made of two metals of unequal expansibility. Thus the transverse rod may be of steel and brass. It carries equal weights at each end. Then the brass being put below, it will expand more by heat, and the bar, A, will curve upwards as the temperature rises, carrying with it its weights, which are so adjusted as to compensate in their rise for the descent of B by the lengthening of C B; and with a little trouble the centre of oscillation can be made to remain unaltered by this means. In cold weather the bar, A, will curve downwards, as the brass will contract greatly and draw the more stable steel with it. Thus the rise of B by the contraction of C B will be balanced by the fall of the weights at the end of A.

The Pendulum as a Measure of Gravity.—The pendulum, by law 4, varies in rapidity of oscillation inversely as the square root of the force of gravity, and hence it becomes one of the very few possible measures of the earth's gravity. It would seem easy to weigh a pound at the equator and weigh the same pound at the pole (or as near it as possible), but in practice it is not only difficult, it is impossible. For to weigh it by scales and weights will not serve, since the weights are themselves subject to gravity. A spring balance shows things to be heavier at the poles, but is subject to so many and so difficult conditions as to be useless for delicate calculation. The isolated and accurately poised pendulum can be measured against a clock, and its slightest difference in rate noted to one oscillation in a thousand if desired. Now an accurately adjusted seconds pendulum will beat at differing rates if carried to different parts of the earth; and this has been several times shown, chiefly by the English and French governments. The finest experiments were those carried out by Colonel Sabine and Captain Forster for our own government. Colonel Sabine tested the pendulum at Spitzbergen and at the equator, and at numberless places between; and found that the seconds pendulum of the equator beat 240 times more in a day (ten beats an hour quicker) at the pole, showing the greater gravity there, arising from the compression of the earth. It is evident that the sharper the pull of gravity upon the bob of the pendulum the more swiftly will it descend, and therefore the quicker it will beat. Thus physicists were able to correct an apparent flaw in the law of gravitation. Newton had said, *supposing the density of the earth to be constant*, then the curvature of the earth would be about 230 at the equator to 229 at the poles. But we find by actual measurement that the proportion of the earth's axes is very different from that, the true proportion being as 300 to 299; and the less proportion is accounted for by the earth's greater density at the poles as proved by the pendulum. The difference of gravity between the poles and the equator is as 180 at the poles to 179 at the equator.

By the fact that the pendulum is attracted from the vertical towards the sea, and drawn away from a mountainous coast, it is proved, in like manner, that the sea-bed is denser than the mountain's mass. By observation of the slackening of its vibration when carried down a deep mine, the density of the earth at that point can be computed, and many other valuable results are obtained from this delicate means of investigation.

Foucault's Experiment.—But all these things are eclipsed in beauty and impressiveness by the famous application of the pendulum by Foucault, as proving *visibly* the rotation of the earth. As a long wire, suitably adjusted with heavy

ball, graduated arc, &c., still hangs in the buildings at South Kensington used for the International Exhibitions, the experiment may be tried by any one who chooses, and it cannot fail to astonish the most careless observer when first seen.

Foucault discovered, in 1851, that the plane in which a pendulum oscillates tends to remain constant. If, for example, a heavy ball, suspended by a fine wire, very long be set swinging without lateral motion, then even if the point of suspension be made to describe a small circle instead of remaining fixed, the pendulum will swing unaltered. The difficulty is to get the pendulum to swing truly; and this is accomplished by drawing back the ball and tying it with fine silk to a fixed point, and letting it rest till all extraneous motion has subsided, then by burning the silk the ball is set free without any bias. Now this extraordinary power of permanence in the plane of oscillation being known, Foucault argued that if such a pendulum were suspended above the pole of the earth, it would appear to sweep out a circle in 24 hours, because the earth would move once round beneath it, the pendulum remaining constant in its original plane of oscillation. At the equator the plane would remain unaltered, of course, and at intermediate stages the amount of motion would vary according to the latitude. The apparent motion of the plane of oscillation varies therefore from 0° a day at the equator to 360° at the poles. The following actual observations are some of many that were made:—

		Observed motion per hour.
Ceylon,	Lat. 6° 56'	... 1° 870
New York,	" 40° 41'	... 9° 733
Paris,	" 48° 50'	... 11° 500
Dublin,	" 53° 20'	... 12° 065
Aberdeen,	" 57° 9'	... 12° 700

Whence follows, by a single calculation, the rapidity of rotation of the earth; which is, from the above data—

	Hrs.	Mins.	Secs.
Ceylon,	23	14	20
New York,	23	8	9
Paris,	23	33	57
Dublin,	24	14	7
Aberdeen,	23	48	49

The average, from a great many experiments, was 23 hours 53 minutes 37 seconds, and as the true time is 23 hours 56 minutes 4 seconds, it is seen how wonderfully close is the approximation, considering all the difficulties of calculation of temperature, accuracy of angular measurement, &c.

When the great pendulum has begun its long swing from 0° to 180° on the graduated circle, and is found after five minutes to be swinging from 1° to 181°, and after ten minutes to be swinging from 2° to 182°, and so on, it is not too much to say that, probably for the first time in his life, the spectator who has grasped the conditions of the experiment *sees the earth move*, and if he is at all impressionable he will be overcome with awe. It is true that the apparent motion of the stars shows the same thing, but then it is practically impossible to most men to realize that the stars are not themselves moving.

PENEIOS (Lat. *Peneus*), the modern *Salamvria*, is the chief river of Thessaly, and is notable in the classic poets as rising in Mount Pindos (Pindus), and passing down the famous vale of Tempê between Mount Ossa and Mount Olympus.

PENELOPE was the daughter of Ikarios, a Lakonian prince, brother of Tandraeos. Penelope was therefore first cousin to Klutainnestra, wife of Agamemnon, and to the beautiful Helena, wife of Menelaos, and heroine of the war of Troy. Ikarios loved his daughter so dearly that even when Odusseus had won the foot-race which he had instituted

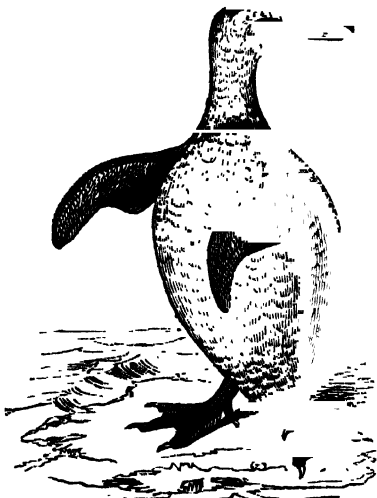
among the many suitors for the hand of Pénélope, between whom he was unable and unwilling to decide, he sought to induce her to remain with him. At last, urged by Odysseus, Ikaros put the question directly to her, whether she would stay with her father in Lakonia or go into wild Ithaka with the young prince. The maiden drew her veil over her face to hide her blushes and remained silent, and her father, overcome by her modest persistence, no longer held out. When Odysseus unwillingly went on the Trojan expedition, he left Pénélope with an infant boy, Télémachos. Ten years rolled on and Troy fell; but another ten were to pass ere the queen was to see again her husband. The rumour was spread that he had died; and when, year after year, nothing was heard of him this did seem most likely. Consequently many of the neighbouring princes came to pay court to the widowed queen, as they thought her. She, left almost without protectors by the absence of her husband and every follower who could bear arms, her son also as yet a mere stripling, was often at her wit's end to hold off their importunities. Many of them also, finding her weakness, took up their permanent quarters in the palace as self-invited guests. The queen with her habitual prudence balanced one against the other, so that amidst mutual jealousies she long remained safe. At last the suitors determined to force her to a decision, and agreed among themselves to abide by it. This drove Pénélope to her last resource. She was weaving a large mantle for the aged Laërtes, father of Odysseus; and she promised as soon as the work was out of hand to make a decision among them. But every night she stole from her room and undid all the day's work, so that the mantle never getting finished, the decision was as far off as ever. The fatal union of the suitors was now joined by her own servants, who betrayed her device. Pénélope began to despair, and finally sent her son, now almost at man's estate, to find his father or seek out his fate. This she felt she must do before consenting to second nuptials. Odysseus about this time arrived home in miserable plight, and while he was gathering strength for the necessary encounter with the crowd of suitors he was joined by Télémachos, who had found no tidings and was returning disconsolately. The way in which Odysseus regained his throne and his faithful wife is told in the article *Odysseus*.

PENGUIN is the name of some remarkable sea birds, formerly considered as forming a family, Spheniscidæ, of the order Anseres, and having a close affinity to the auks (*Alcidæ*), but now regarded as forming a distinct order, to which the name *Impennes* has been given. The penguins are remarkable for the rudimentary state of their wings, which are useless for flight, immovable except at the shoulder joint, and totally destitute of quills, being covered with small bristle-like feathers. These curious organs serve as paddles to assist the bird in swimming in the water, and they are sometimes used as fore legs to aid progression on land. The body is elongated, somewhat oblong in shape, and covered with small scale-like feathers. The tarsi are placed so completely behind that, in resting, the birds assume naturally an upright attitude. The toes are webbed, and the tarsi very stout and short. The bones, unlike those of birds in general, are hard, compact, and heavy, and have no apertures for the admission of air, those of the extremities containing an oily marrow. These birds are essentially aquatic, seldom visiting the shore, except during the breeding season, and their progress on land is very singular. While swimming they are immersed above the breast. All are natives of the colder or moderate seas of the southern hemisphere, extending to the extreme south. The penguins appear to be all gregarious in their habits, and to form large rookeries, the economy of which is described as being conducted with order and regularity.

Three genera of penguins have been recognized, *Aptenodytes*, *Eudyptes*, and *Spheniscus*. *Aptenodytes*, distin-

guished by the long slender bill, compressed on the sides and slightly curved at the tip, contains the Emperor and King penguins (*Aptenodytes forsteri* and *pennanti*) which were formerly confounded together under the title *Aptenodytes patagonica*. The former species is 50 inches in length, the latter 44. The general colour of both is slaty above and white below, with the head and throat black. Both these species are found near the Straits of Magellan, the Falkland Islands, and other islands in the South Pacific.

The following account of a colony of King penguins is given by Dr. Bennett. They were seen at the north end of Macquarie Island, in the South Pacific Ocean, and covered an extent of 30 or 40 acres. He describes the number of penguins collected together in this spot as immense, but observes that it would be almost impossible to guess at it with any near approach to truth, as during the whole of the day and night 80,000 or 40,000 are continually landing and an equal number going to sea. "They are arranged, when on shore, in as compact a manner and in as regular ranks as a regiment of soldiers; and are classed with the greatest order, the young birds being in one situation, the moulting birds in another, the sitting hens in a third, the clean birds in a fourth, &c.; and so strictly do birds in similar conditions congregate, that should a bird that is moulting in-



Jackass Penguin (*Spheniscus demersus*).

trude itself among those which are clean, it is immediately ejected from them. The females hatch the eggs by keeping them close between their thighs; and, if approached during the time of incubation, move away, carrying their eggs with them. At this time the male bird goes to sea, and collects food for the female, which becomes very fat. After the young is hatched, both parents go to sea, and bring home food for it; it soon becomes so fat as scarcely to be able to walk, the old birds getting very thin. They sit quite upright in their roosting places, and walk in the erect position until they arrive at the beach, when they throw themselves on their breasts, in order to encounter the very heavy sea met with at their landing-place."

The genus *Spheniscus*, in which the bill is much shorter, and ends in a conspicuous hook, contains the Jackass Penguin (*Spheniscus demersus*), so called from the resemblance of its cry to a bray. It is a small species found at the Cape of Good Hope. In the genus *Eudyptes* the bill is short and broad. The Crested Penguin (*Eudyptes chryso-*

roma), called "rock-hopper" by sailors, inhabits the Falkland Islands and Tasmania. It is about the size of a duck, black above and white beneath, with a yellowish-white crest on each side of the head. Its voice is harsh and discordant.

PENICILLIUM is a genus of fungi. *Penicillium glaucum* (blue mould) is very common on damp substances, and even on liquids. It forms a dense felt on the substance on which it grows, putting up jointed threads (*hyphæ*), at the tips of which are produced chains of conidia. The conidia break off and are dispersed in numbers everywhere in the air, each having the power of reproducing the mould on settling on a suitable object. Recently a process of sexual reproduction has been discovered in *Penicillium*, by which it is seen to be very nearly allied to the edible truffles. The fructification corresponding to the truffle is yellowish, and about the size of a small pin's-head; it is only produced when the mould is deprived of air and of light, so that the production of conidia is checked.

PENN, WILLIAM, the Quaker, the only son of Admiral Sir W. Penn, was born in London, 14th October, 1641. His first bias towards the doctrines of the Society of Friends, or Quakers, appears to have been given by the preaching of Thomas Loe—the effect of which was, that while at Oxford, Penn, together with some of his fellow-students, began to withdraw from attendance on the public worship of the Established Church, and to hold private prayer meetings. They were fined by the college for non-conformity; but this did not deter them, for an order from the king having required that the ancient custom of wearing surplices should be revived, Penn and his associates attempted to tear them from the backs of those students who wore them. For this display of intemperate zeal they were expelled from the college.

After travelling on the Continent he returned to London, and was admitted a student of Lincoln's Inn, where he continued till 1666, when his father sent him to Ireland for the purpose of managing his estates in that country. Happening to attend a religious meeting at Cork, his early religious impressions were renewed, and from this time he constantly attended the Quakers' meetings. At one of these, held at Cork in 1667, he and others were apprehended by order of the mayor, who would have set Penn at liberty on his giving bail for his good behaviour, but he refused, and was sent to prison with the rest. He wrote, however, to the Earl of Orrery, then lord president of Munster, requiring the release of all, but the earl contented himself with ordering Penn alone to be set at liberty. Admiral Penn now summoned his son home, and remonstrated with him, but in vain. The admiral at last restricted himself to the demand, that he should take off his hat in the presence of the king, the Duke of York, and himself. But Penn refused even this limited degree of "hat worship," and the admiral was so much incensed that he turned him out of doors.

In 1668 Penn began to preach, and also published his first work, "Truth Exalted." In this year he also produced "The Sandy Foundations Shaken," in which he professed his belief in the doctrine of the Trinity, but objected to the language in which it was expounded by the Church of England; and for this he was committed to the Tower. During his imprisonment, which lasted nearly nine months, he wrote his "No Cross, No Crown," one of his most popular works. In 1669, after his liberation, a reconciliation took place between him and his father, and he again went to Ireland, where he remained about twelve months.

In 1670 the Conventicle Act was passed, and Penn was one of the first sufferers under it. He was committed to Newgate for preaching to what was called "a riotous and seditious assembly," which consisted of the Quakers, who had been excluded from their chapel, and who now met in the open street, as near to it as they could. The jury,

in opposition to the direction of the bench, and in defiance of its threats, pronounced a verdict of acquittal. Soon after this Admiral Penn died, perfectly reconciled to his son, to whom he left estates worth £1500 a year, and a claim on the crown for £15,000 advanced by him to Charles II. In February, 1670–71, Penn was again committed to Newgate on a charge of preaching publicly, and he remained in prison six months. In 1677, in company with George Fox and Robert Barclay, he made a sort of religious tour in Holland and Germany. After his return he was admitted to plead before a committee of the House, that the solemn affirmation of the Quakers should be admitted in the place of an oath, and to this effect an enactment passed the Commons in 1678, but was lost, in consequence of a prorogation, before it had passed the Lords.

We now come to an important event in Penn's life, the establishment of the colony of Pennsylvania. A tract of country on the west side of the Delaware was granted by Charles II. to him and his heirs, in consideration of the debt of £15,000, and to this the Duke of York added by cession a contiguous portion of territory lower down on the Delaware. The king's patent was dated 4th March, 1680–81, and in this document he named the province, in honour of the founder and his father, Pennsylvania. Penn was constituted its absolute proprietor and governor. He published "Some Account of Pennsylvania," &c., and also "Certain Conditions or Concessions," &c., in which he offered easy terms of settlement to those who might be disposed to emigrate. Three ships soon set sail with settlers from England and Wales, chiefly Quakers. In 1682 he published "The Frame of the Government of the Province of Pennsylvania in America," and sailed for that country. Having founded the city of Philadelphia on the banks of the Delaware, and spent about two years in the province adjusting its political constitution on a very liberal and democratic basis, he returned to England about Midsummer, 1684. Within this short period no less than fifty sail arrived in the province with settlers from England, Ireland, Wales, Holland, and Germany.

In February, 1685, soon after Penn's return to England, Charles II. died, and the favour with which James II., when Duke of York, had regarded Admiral Penn was transferred to his son. After the Revolution in 1688 his intimacy with James II. exposed him to suspicions, and he was four times arrested on accusations of being a concealed papist and a Jesuit. His connection with the court has furnished Macaulay with certain grave charges of conspiracy, treachery, and Jacobitism, but these have been most successfully refuted by Penn's later biographers. In 1692 he was deprived of the governorship of Pennsylvania by an order of council, but two years later he was restored, and in 1699 he again sailed for Pennsylvania, with the intention of making it the place of his future residence. Singularly successful in his dealings with the Indians, he found the colonists, however, extremely refractory and quarrelsome, and he returned to England in 1701. His closing years were embittered by family troubles and heavy pecuniary losses, and at one time he was incarcerated for nine months in the Fleet for resisting an unjust claim made against him. In 1712 he had the first of a series of paralytic attacks, which, after enfeebling his mind and destroying his memory, ended in his death, 29th July, 1718. See Hepworth Dixon's "Life of Penn" (1851), and Paget's "Reply to the Charges of Lord Macaulay" (1858).

PENNANT GRIT, in geology, the name given to a series of hard, thick-bedded sandstones forming the middle division of the coal measures in the South Wales and Somersetshire coal-fields. According to Sir Henry de la Beche it attains a thickness of about 3216 feet in the neighbourhood of Swansea, but only comprises fifteen coal seams of which five are more than 2 feet thick. In Somersetshire the Pennant series appears to vary from 1500 to 2000 feet,

and includes at most five workable seams of coal. In South Wales the "Cockshoot rock" forms the base of the division, and wherever these beds come to the surface their hard, massive character produces bold scenery.

PEN NANT, THOMAS, D.C.L., F.R.S., naturalist and antiquary, was born of an ancient Welsh family, at Downing, in Flintshire, 14th June, 1726. He was educated at Wrexham School, and subsequently at Oxford, but took no degree in that university. At the age of twelve he had been inspired with a passion for natural history, and a tour in Cornwall in 1746-47 awakened in him a strong interest in minerals and fossils. In 1754 he was elected a fellow of the Royal Society of Antiquaries, and in 1757, at the instance of Linnaeus, he was made a member of the Royal Society of Upsala. In 1765 his reputation was established by the publication of the first part of his work on "British Zoology," and while the work was in progress he visited the Continent, where he made the acquaintance of Buffon, Voltaire, Haller, and Pallas. In 1771 he published a "Synopsis of Quadrupeds," which was afterwards enlarged and republished under the title of a "History of Quadrupeds." At the end of the same year he published "A Tour in Scotland in 1769," which proved so popular that he followed it by a history of a second journey to Scotland in 1774; a "Tour in Wales" in 1778; a "Journey to Snowdon" in 1781-83; and a "Journey from Chester to London" in 1782. In respect to these works Dr. Johnson observed, "Pennant is the best traveller I ever read; he observes more things than any one else does." His "Arctic Zoology," a meritorious compilation, was brought out in 1785-87, and in 1790 appeared his "Account of London," one of the most popular works on the subject ever published. An amusing account of "The Literary Life of the late T. Pennant, by himself," was published in 1793, and he then commenced a work entitled "Outlines of the Globe," vols. i. and ii. of which appeared in 1798, and vols. iii. and iv., edited by his son, David Pennant, in 1800. He died at Downing, 16th December, 1798, in the seventy-second year of his age, having won for himself the fame of a most devoted student of natural history, a keenly observant traveller, and a singularly instructive and indefatigable writer.

PENNINE ALPS. See **ALPS**.

PEN NON, in heraldry, a small flag with one or two points. Such flags were carried by the mediæval knights on their lances, immediately below the head, and in addition to bearing the personal device or badge of their bearers they were usually fringed with gold. The device was so placed upon the flag that it appeared in its proper position when the lance was levelled for the charge. The *Pennoncille* was a smaller flag of the same kind.

PENNSYLVANIA (from *Penn*, the name of its Quaker founder, and *lat. sylva*, a wood), one of the largest and most important of the United States of North America, bounded east by New Jersey and New York, west by Ohio, north by New York and Lake Erie, and south by Virginia and Maryland. The length east to west, is 307 miles; the width, north to south, is 160 miles. The area is 46,000 square miles. The population in 1881 was 4,282,738.

Surface.—The Alleghany Mountains extend through the centre of the state in a general direction from S.S.E. to N.N.W. In the south they form the watershed between the streams which descend eastward to the Potomac and Susquehanna, and those which flow westward to the Ohio. The summit of the range is broad, of nearly equal elevation, and from 2000 to 2500 feet above the sea. East of the Alleghanies are five or six ridges of much less elevation. The most eastern of them is called the Blue Mountains, which extend N.E. to the river Delaware. The higher parts of the mountain ridges are covered with pines and cedars of various kinds. The soil in the lower parts

is generally good; the richest is in the south-east, on both sides of the Susquehanna.

Rivers.—The most important river of Pennsylvania is the **DELAWARE**. The Susquehanna rises in two branches; the eastern has its source in Lake Otsego, in 74° 40' W. lon., near the western declivity of the Tuscaraora Mountains, in the state of New York; and the western originates in Pennsylvania, in 78° 40' W. lon. After the junction the river flows S. and S.E., and falls into Chesapeake Bay, its entire course being about 500 miles. It is not navigable, owing to the rapidity of its current and the numerous rocky ledges over which it flows; but it affords communication with the interior, by the aid of various canals constructed along its banks. The Juniata, after a course of about 180 miles, enters the Susquehanna on the west, 11 miles above Harrisburg. It is one of the most picturesque streams in the United States. The Lehigh joins the Delaware at Euston, and the Schuylkill enters it 5 miles below Philadelphia. The latter is connected with the Susquehanna by a canal. The Brandywine rises in Pennsylvania, and also falls into the Delaware. The western part of the state is drained by the two principal branches of the Ohio—the Alleghany and the Monongahela.

Climate and Productions.—In the mountainous region the winters are severe; the cold is greater in the western than in the eastern part of the state. In the south-east the winters are mild, and most of the finer fruits of temperate climates are raised. The soil is productive and well cultivated, and the herds of live stock are very extensive. The black bear and the wolf are still found, and snakes are generally harmless, but the copper-head and the rattlesnake are often found. Large quantities of tobacco are grown and exported. The district abounds in minerals, and so much iron and coal are raised that this state has become the headquarters of manufacturing and railway enterprise in the Union. From the western declivity of the Alleghany Mountains bituminous coal-fields extend into Maryland and Virginia, and occupy many thousands of square miles. This coal is mostly wrought in the neighbourhood of Pittsburgh, where it is used for manufacturing purposes. The anthracite coal-field, which lies to the east of the Blue Ridge, extends over 450 miles. About three-fourths of the total quantity of coal raised throughout the United States is obtained in Pennsylvania, which also contains abundance of iron ore, lime, marble, and slate. Zinc, plumbago, and lead are also found; and nitre, or salt petre, exists in an extensive deposit and of great richness in the central part of the state. But the most important product is petroleum. Its development rivals the history of the discovery and progress of the gold mines of California, and exceeds in rapidity of expansion the results realized from the coal mines of this state during an equal period.

In addition to its mineral treasures Pennsylvania is also an eminently agricultural state, and, as before stated, the soil is productive and well cultivated; in fact, there is probably no more skilful farming in the United States than is to be found in some of the older parts of the state. Pennsylvania produces more buckwheat, rye, and clover-seed than any other state, more Indian corn than any northern or middle state, and more potatoes, orchard fruits, butter, hay, and oats than any state except New York. She is the third in the amount of wool, and fifth or sixth in the amount of wheat produced. The best soils are in the limestone and river valleys, and in the depressions among the mountains, which have a rich alluvium of 2 or 3 feet deep. There are large tracts of excellent land in the bituminous coal region of Western Pennsylvania; but the northern counties are more bleak and rugged, and not quite so productive.

This state ranks among the first in the Union in manufacturing industry, and produces nearly one-half of all the

pig-iron made in the country. The most important establishments are the coal and iron mines, furnaces, and foundries, and the petroleum works and refineries; but there are also factories for making cotton and woollen stuffs, and yarn, soap, paper, gunpowder, carriages, &c. Ironmongery of all descriptions, and steam-engines and machinery, are made in large quantities at Pittsburgh. The foreign trade is carried on chiefly through Philadelphia, but in part *via* New York and Baltimore. The population is very mixed, including a great number of Germans, whose ancestors were originally attracted thither by the broad principles of toleration laid down by Penn. Religious creeds are not less various; Methodists, Presbyterians, Lutherans, Baptists, German Reformed, and Friends are, however, the prevailing sects. The capital is HARRISBURG.

History and Constitution.—Pennsylvania was originally settled by the Swedes in 1627, was conquered by the Dutch in 1654, and was ceded to the British in 1661. It was granted to William Penn, and after his death was sold by the proprietors to the United States. The constitution, as amended in 1874, gives the franchise to citizens twenty-one years of age, and of one year's residence, but it is required that those who have reached twenty-two should have paid taxes for two months before voting. The supreme judges are elected for twenty-one years, the district judges for ten years.

PENNY, the present chief copper (*i.e.* bronze) coin of England; in Latin *denarius*, whence the *d.* in our familiar *£ s. d.* The word *penny* has nothing to do with the word *denarius*, though it is ultimately also of Latin derivation. Its oldest English form was *penning*, then *pening*, and consisted of the suffix *-ing* and the base *pend*, representing the Low German *pend* and High German *pfund* (whence the modern German *pfennig*), both of them coming from Latin *pennus*, in the sense of pawn, a pledge or token. The piece of silver was a pledge redeemable with goods, rather than wealth in itself, to our forefathers—a highly philosophic and accurate view of money. The denarius, the ancestor of the penny, was a silver coin, first issued at Rome B.C. 269, being, as its name implies, the 10-as piece, with a half piece (quinarius), and a quarter piece (sestertius). Its legal weight was 4 scruples=72 grains, giving the quinarius 2 scruples and the sestertius 1; and the Roman pound of silver produced consequently 72 denarii, 144 quinarii, and 288 sestertii. Its value was reduced in 217 B.C., and 80 were struck to the pound (falling to 84 by the beginning of our era); the other coins gradually dropped off, but the denarius retained its hold, and was regularly coined at this standard for over three centuries. When the change was made in B.C. 217 the relative value of the as was at the same time reduced, so that 16 ases now went to the denarius. But the sign of value, X, stamped on the denarius behind the head of Roma, remained unaltered. In B.C. 84 the first gold coinage of Rome was issued, the aureus=25 denarii. About B.C. 90 the head of Roma was occasionally varied by that of other goddesses, and in B.C. 41 it was superseded by the head of Julius Caesar, at the order of the senate. From this time the usual type of coin is that bearing a portrait of the issuer. Brutus issued a denarius after the murder of Caesar, bearing his own head on the one side and on the other a cap of liberty between two daggers, with the legend EID. MAR. (the Ides of March, the date of Caesar's murder).

Deteriorations of the later Cæsars brought down the purity of the currency, and by A.D. 215 the gold aureus, once weighing the fortieth of a pound, was only the fiftieth, while the denarius, so long kept at a high standard, was reduced to 40 per cent. of silver only. Caracalla introduced a new silver coin, the denarius and a-half, which he called the *Argentus Antoninianus*, and which speedily became the principal coin of the empire; it was struck at about 60 to the pound. Then the coinage sank into such confusion

that Diocletian, in 296, had to intervene in his practical way, and settled the difficulty by a new issue. Diocletian's gold aureus was issued at 60 to the pound, and a new silver coin took the place of the silver denarius, a *copper denarius* being issued now for the first time. Thus we reach the copper coin of our *£ s. d.* (The *s.* is for *solidus*, a smaller gold aureus of Constantine's introduction, which eventually was reduced to silver; and the *£* is for *libra*, pound.)

When the first Frankish emperor, Karl (or Charles) the Great, started the silver mediæval coinage he used as his basis a denarius (which he called in German a *pfennig*), which was the 240th part of a pound weight of silver. Here we get our word *penny*, and our division of the pound into 240 pence. Karl's German word for *solidus* was *schilling*, and he made his *solidus* the twentieth of a pound. The names and divisions of the English coinage are therefore the oldest in Europe, and alone perpetuate the earliest Teutonic system.

The silver penny was the first silver coin struck in England, and was the only one current till the Conquest. It weighed about 22½ grains troy—being the 240th part of the pound. Down to the middle of the reign of Henry II. each "moneyer" was responsible for the purity of his own coin, and his name and the name of his town are usually stamped on the coin. But Henry II. appointed an overseer of moneyers, who was directly responsible to the king. Up to the time of Edward I. it was struck with a cross so deeply indented that the coin could very easily be divided into two for halfpence and four for farthings—hence their names. Edward I. first coined halfpence and farthings, and groats of fourpence. His type of penny—king's head, full face, not profile, *obverse*, and a long cross paty *reverse*, with three pellets in each angle—remained unaltered till Henry VII., who altered the bust to a profile. The coin was gradually reduced in size until the reign of Elizabeth, when it only weighed 73½ grains, or the sixty-second of an ounce. In 1672 copper halfpence and farthings were coined, but copper penny were not introduced till 1797. The copper coinage was replaced by the present one of bronze in 1862. The penny is now rated at something like 75 per cent. above its real value, but as its issue is confined exclusively to the government, and it is not a legal tender for any amount above a shilling in any one payment, this over-valuation is not productive of any bad effect.

It is not generally known that we once had a *gold penny* in England. This was coined by Henry III. in 1257, and bore the king enthroned, *obverse*; a cross voided, cantoned with roses *reverse*; its value being at first 20, and later on 26 silver pence. It proved so unpopular that it had to be withdrawn. No gold coinage was issued till 1313, when Edward III. began the issue of *nobles*.

PENNY BANKS, banks for the use of very poor people, receiving deposits even as low as a penny, in order to encourage thrift. See SAVINGS BANKS.

PENNYROYAL (*Mentha Pulegium*) is a species of the genus *MENTHA*, allied to the common MINT. It is a perennial herb not uncommon in damp gravelly places in England and Ireland, extending over the whole of Europe except the extreme north, and occurring also in portions of Asia and Africa. It has a strong odour which resembles that of spear-mint, but is less agreeable. Its properties are due to the presence of a volatile oil, which is obtained by distillation. Pennyroyal was formerly valued as a medicine, but is superseded except as a domestic remedy. Like the other mints it possesses carminative and stimulant properties. The American Pennyroyal (*Hedeoma pulegioides*) belongs to a nearly allied genus. It has similar properties to the European pennyroyal and other mints, and has obtained a place in the United States Pharmacopæia. In the form of a warm infusion it is useful as an emmenagogue.

PENOBSCOT, a river of the United States of America, which is formed by the union of several streams in the west of Maine, and falls into the bay of the same name, after a course of about 275 miles. It is navigable to Bangor, a distance of 20 miles, where the rise of tide is 17 feet.

PENRITH, an ancient and well-built town of England, in the county of Cumberland, 283 miles from London, and 17 S.S.E. from Carlisle by the North-western Railway. It is situated in a fertile vale near the borders of Westmorland, at the foot of Beacon Hill, which is 1020 feet high, and is crowned by a ruined castle. This castle, built in Edward IV.'s time and the residence of Richard III., was taken by the Parliamentarians, and soon after dismantled. The church is a large and handsome structure, newly rebuilt in the beginning of last century; on its walls are many curious old inscriptions, and in the churchyard is a rude monument called the Giant's Tomb, consisting of two stone pillars, 10 feet high and 13 feet apart. There are also a modern church, several dissenting chapels, a free grammar-school, literary institute, assembly rooms, museum, and a house of correction. The town has a good trade—the surrounding district being very fertile, and producing large quantities of potatoes. There are some iron-foundries, saw-mills, and breweries. The scenery around is very fine. The population of the town in 1881 was 9268.

Penrith has been derived from *Petrian*, an old Roman station, or the British *pen* and *rhudd*, meaning red hill. However this may be, it is a town of considerable antiquity, and often suffered in the border wars. There are some interesting objects in its vicinity, among which may be specified Lowther Castle, a magnificent modern structure, the seat of the Earl of Lonsdale; with Brougham Hall, Eden Hall (containing the fairy cup, "The Luck of Eden Hall"), Greystoke and Dacre Castles, the Giant's Cave, King Arthur's Round Table, and other British antiquities scattered over the district.

PENRITH SANDSTONE, a division of the Permian strata occurring locally in Cumberland, and largely used as a building stone. Beds of sufficient durability to be employed thus are comparatively uncommon among British Permian rocks.

PENRYN, a municipal borough of England, in the county of Cornwall, situated on an inlet of Falmouth harbour, about 2 miles north-west of Falmouth, and 308 from London by the Great Western Railway. The town stands partly on a low hill and partly in a warm, sheltered, and richly productive valley, which projects into the inlet, and divides it into two navigable branches. At the point between these two branches is the public quay, from which the main street extends westward over the bridge of the hill, with streets and lanes running into the valleys on each side. It has a parish and three dissenting churches, grammar-school, paper and corn mills, and a harbour, at which about 20,000 tons of granite are exported annually. Shipbuilding and the working of granite are the chief industries. The population in 1881 was 3463.

PENSACOLA, a town of the United States of America, situated on the western border of the state of Florida, on a sandy flat of a bay of the same name, in the north of the Gulf of Mexico. It is regularly built, and has a harbour with a depth of 21 feet, and one of the safest in the gulf, commanding a considerable trade. In the vicinity there is a large dockyard and naval station of the American government, and the entrance to the bay is strongly fortified. The population in 1880 was 6845.

PENSION (Lat. *pensio*, from *pendere*, to weigh out, to pay) is an allowance paid annually by government to an individual in consideration of past services, civil or military. In times gone by hereditary pensions were awarded very carelessly, and for unworthy considerations; but they are now practically obsolete.

PEN'SIONARY, GRAND, was the name generally given to the first magistrate of the republic of Holland, who was a member of the Seven United Provinces of the Netherlands. The Pensionary was the president of the council of the states or legislature of Holland, and he was for the time the first minister of the republic. He was elected for five years, but was generally confirmed indefinitely, and often for life.

PENTACRINUS. See SEA LILY.

PENTADESMA is a genus of plants belonging to the order GUTTIFERÆ. Only one species is known, *Pentadesma butyracea*, the butter and tallow tree of Sierra Leone, so called because a yellow greasy substance is obtained from different parts, especially from the fruit. The fruit is large and conical, and is eaten by the natives.

PENTAMERA is one of the large sections into which Latreille divided the order Coleoptera or BEETLES. The name has reference to the five joints in the tarsus. The classification is generally abandoned now by entomologists as artificial and useless, and the beetles are either divided as at one time into a large number of families or into a number of small groups, such as BRACHELYTRA, CLAVICORNIA, LAMELLICORNIA, MALACODERMÆ, PALPICORNIA, all of which are included in the section Pentamera.

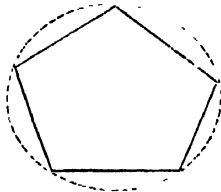
PENTAMETER, a species of verse consisting of five feet or measures (whence the name), which, when subjoined to an hexameter verse, composes an *elegiac couplet*. The formula may be thus designated—

It has been introduced into English, but seems alien to the genius of our language. A good example is given by Coleridge in a translation from Schiller:—

"In the hex | ameter | rises the | fountain's | silvery | column,

In the pen | tamer eye | falls | melody | back."

PENTAGON (Gr. *pente*, five, *gōnia*, an angle), any five-angled geometrical plane figure, and hence any five-sided figure, since the one implies the other. A regular pentagon has all five sides and all five angles equal. Euclid describes it in a circle by first drawing within the circle an isosceles triangle, each of whose angles at the base is double of the third angle, and then bisecting those angles at the base. He thus gets five equal angles, and as equal angles stand on equal arcs, he gets the circle evenly divided by five points, which are the points of the pentagon. Or a regular pentagon may be easier drawn by rule of thumb, by considering that all its angles must be equal to six right angles (twice the number of right angles that the figure has sides, less four right angles), and that each one is therefore equal to 108 degrees. If now, at a point on the circumference at the extremity of any diameter of a circle, an angle of 54 degrees be set off each way, and the lines carried to meet the circumference, these lines will contain an angle of 108 degrees, and will be two sides of the regular pentagon, describable in that circle.



Pentagon.

PENTASTOMUM is a remarkable genus of parasitic ARACHNIDA, forming an order, Pentastomida. The body of Pentastomum is elongated and worm-like, and is chiefly formed by the abdomen, which is marked by superficial annulations. Legs are entirely absent in the adult, but on each side of the mouth are two curved hooks which can be protruded from pouches in the skin. There is a straight

simple alimentary canal running throughout the body. Organs of circulation and respiration are wanting; the nervous system is very simple, and there are no eyes. The sexes are distinct, and the males are much smaller than the females.

The species of *Pentastomum* when adult inhabit the air chambers of mammals, birds, and amphibians. *Pentastomum tenuicoides* has a life-history not unlike that of the tapeworms. This species in the adult condition inhabits the nasal cavities and frontal sinuses of dogs and other carnivores. Their eggs pass out with the nasal mucus, get on to plants, and are swallowed by hares and rabbits, rarely by men. The embryos escape from the egg, pierce the intestine, and reach the liver, where they encyst themselves and undergo a series of moults. After some months they appear in the form formerly known as *Pentastomum chaliculatum*, with an oval tapering body and four legs, each being terminated by a double hooked claw. If the flesh of their host, the hare or rabbit, be now devoured by a dog, the parasites penetrate into the nasal cavities or frontal sinuses, and there become sexually mature.

PENTATEUCH (Gr. *pen-te*, five; *teuchos*, a book), the Alexandrian Greek name used in the Septuagint for the five books of the Hebrew Scriptures traditionally ascribed to Moses, which by the Jews generally are termed the *Torah*, i.e. the law, or *Torath Mosheh*, the law of Moses. The rabbinical title is *Chamisha Chumshe Torah*, or the five-fifths of the law. The division into five portions is of very remote date, and is probably older than the Septuagint translation. In its present shape, the whole forms one connected historical work, beginning with the creation of the heavens and the earth, and ending with the death and burial of Moses. The story is continued on the same lines in the Book of Joshua, and some modern scholars prefer to add this to the first five books, and to refer to the whole as the Hexateuch. Elsewhere we have noticed the structure, &c., of the different books [see GENESIS, EXODUS, &c.] and in the present article we have only to deal with the questions which have been raised in modern times respecting the authorship and history of the whole.

Beginning with the Old Testament, we find in the books of the Chronicles references to the book of the law of Moses (2 Chron. xxv. 4; xxxv. 12, &c.), and from these and similar references in the Apocrypha it is evident that at a period considerably earlier than the birth of Christ, the Pentateuch was regarded by the Jews as being the work of Moses. At the time when the New Testament was written, this belief was everywhere accepted among the Jews, and we find numerous quotations from, and references to "Moses and the Prophets" in the books of the New Testament itself. Josephus, who lived 38-97 A.D., in his treatise against Apion, expressly asserts that the Hebrew Scriptures included five books of Moses. The later rabbins were practically unanimous in ascribing the whole of the Pentateuch to Moses, with the exception of the last eight verses of the book of Deuteronomy, and from the synagogue this belief passed into the church, where it was received and accepted with unhesitating credence. By some of the minor sects which arose during the first centuries of Christian history, the authenticity of the Jewish law was called in question or denied; but the orthodox party only insisted the more strongly upon its acceptance, and the traditional belief remained without serious disturbance until the close of the last century. During the mediæval period indeed ANKEN EZRA pointed out that some passages in the Pentateuch were obviously interpolations, and that many others were hard to reconcile with the commonly accepted theory of the Mosaic authorship, and he quotes another and earlier rabbi who had maintained that a portion of Genesis must have been written in the reign of Jehoshaphat; but it was not until some time after the Reformation that the question of authorship was seriously discussed by scholars. Hobbes

maintained that the Pentateuch could not be of Mosaic authorship ("Leviathan," xxxiii.), and Poyrierius showed that the structure of some portions of the history pointed unmistakably to a composite authorship ("Syst. Theol." 1655); but it was left for Spinoza to anticipate by a bold conjecture many of the modern theories upon the subject, and to ascribe the present form of the Pentateuch to Ezra, whom he represented as the editor and redactor of a mass of material composed at different periods of Jewish history (Tr. "Theologico-pol." vii.). The traditional theory, however, received the support of the leading scholars and divines both of the Roman Catholic and the Protestant Churches, and it was not until the middle of the eighteenth century that the first important step in the direction of modern critical study was taken by Jean Astruc, a French physician, whose "Conjectures sur les Mémoires originaux, dont il paroît que Moïse s'est servi pour composer le Livre de Genèse" was published in 1753 at Brussels. Astruc observed that throughout the Book of Genesis and the earlier chapters of Exodus, traces were to be observed of two original documents, each characterized by a distinct name for the deity, viz. Elohim and Jahveh (Jehovah), and following the line of investigation thus opened, he came to the conclusion that Moses had used twelve separate documents in the composition of the narrative. This theory attracted very little attention at the time, and nearly thirty years had passed when it was brought into prominent notice by Eichhorn in his "Introduction to the Old Testament," published in 1780. Supported by so great an authority, the "documentary theory" of Astruc proved a point of departure in the study of the subject, and starting from it Geddes, Vater, Hartman, and others came to the conclusion that the Pentateuch consisted of a number of fragments of ancient history, law, tradition, &c., loosely strung together by an editor, but without any proper order or design. This theory, known as the "fragmentary hypothesis," had but a short life, however, for investigation soon proved the unity of design pervading the whole of the Pentateuch, and a new theory was propounded, to the effect that one document might be clearly distinguished as forming the basis of the narrative, to which supplementary additions had been made, and with which various particulars of later date had been incorporated. This theory received the support of some of the ablest scholars of Germany, such as De Wette, Bleek, Stahlin, Tuch, Knobel, Bunsen, and others; but there was little or no agreement among the advocates of this theory as to the details of the supposed processes of addition, interpolation, &c. By the majority of the supporters of this hypothesis the foundation of the Pentateuch was supposed to be the work of an unknown author, who, from his use of the term Elohim, was termed the Elohist, and it was thought that another and later writer, who was called the Jahvist, from his use of the name Jahveh, had by abridging, copying, and interpolating, incorporated the book of the Elohist in a history of his own. As to the date of the composition of the original work and its subsequent use by the Jahvist the widest differences of opinion prevailed, some critics accepting the opinion of Bleek—that the earliest portions of the Pentateuch were composed in the age of Moses—while others brought them down to the reign of David or Solomon, while the completion of the work was variously assigned to the ages of Solomon, Ahaz, Josiah, Jeremiah, &c. In spite of these differences of opinion, however, this view, distinguished as the "supplementary hypothesis," remained dominant among the more advanced German critics until just after the middle of the present century, when it was modified considerably by the researches of Graf, Vatke, George, Kuenen, Wellhausen, and others, but not until it had been introduced into English thought by the writers of the celebrated "Essays and Reviews" in 1861, and the more important works of Dr. Colenso, the first part

of whose "Pentateuch and Book of Joshua Critically Examined" appeared in 1862. A work so subversive of the opinion commonly maintained in England, coming from the pen of an Anglican bishop, at once attracted the attention of the religious world, and the matter was considered of such importance that nearly 300 "replies" to Colenso were issued from the press during the next few years, while a most remarkable impetus was given to the study of Scriptural criticism generally. As we have already stated, the advocates of the supplementary theory differed widely among themselves as to the details of the supposed process of composition, and it is impossible within the limits of this article to notice the different results arrived at by their methods of criticism. As an outline of one of them, however, we may notice the main points insisted on by Colenso as the results of the labours of his predecessors and his own original investigations. (1) The early history of the Old Testament is purely legendary, and the patriarchs, and possibly even Moses, are mythical persons. (2) The basis of the Pentateuch is to be found in the work of an Elohist writer, probably Samuël, who lived before the institution of the monarchy. To this is added the work of (3) the second Elohist, who wrote about the end of the reign of Saul, or early in that of David. (4) Then follows that of the Jahvist or Jehovist, who wrote at the end of David's reign or the beginning of Solomon's, probably Nathan, or perhaps identical with the second Elohist. (5) Still later we have the Deuteronomist, supposed to be Jeremiah; and (6) lastly, some portions must be ascribed to certain Levitical legislators who wrote after the Captivity. It was further assumed by the bishop that the resources of modern criticism were equal to the task of assigning to each writer his portion of the work. Taking the division into verses for a standpoint, he ascribed 377 verses in Genesis and Exodus to the Elohist; 377 verses in Genesis, Exodus, and Numbers to the younger or later Elohist; 126½ verses in Genesis, Exodus, and Numbers, with six and a half in Deuteronomy, to the Jahvist; to the prophet Jeremiah the whole of Deuteronomy, save the six and a half verses already mentioned, and ten added by the Levitical legislators; while to the latter are also assigned 621 verses in Exodus, 859 in Leviticus, and 1009½ in Numbers. Similar divisions had been attempted by several of the advocates of the supplementary theory; but, as we have already indicated, there was but little substantial agreement among them either as to the main divisions of the Pentateuch or the minor divisions into passages.

While, however, the controversy opened by Colenso was being waged with the utmost zeal in England, a new theory altogether was propounded in Germany by K. H. Graf, which has since received the support of Professor A. Kuenen of Leyden, and still more recently of Professor J. Wellhausen, by whom it has been developed and defended with so much ability as to cause it to be most generally called after his name. The chief feature of this theory is that it is used upon an entire reconstruction of the history of ancient Israel. Starting with the period covered by the opening of the Book of Judges as the earliest authentic history attainable, it is assumed that the original worship of the nation was that of Baal and the gods of the Canaanites, among whom Jahveh or Jehovah was regarded as the especial patron of Israel. The worship of these deities was of a rude and somewhat ferocious character, involving the offering of human beings as sacrifices, as well as of beasts and birds. In the course of time this primitive religion developed into one more refined and spiritual, until, chiefly by the labours of the prophets, it assumed the shape with which we are most familiar, of a monotheistic worship involving an elaborate ritual, and having its centre at Jerusalem. While this change and development are regarded as being the work of several centuries, there are three distinct epochs noted,

each of which was of vast importance in the history of Israel. The first of these is supposed to be the centralization of the national worship instituted by Josiah (2 Kings xxii. xxiii.); the second covers the period between Josiah and the close of the exile; and the third commences with the work of Ezra and his successors, and continues for the next century and a half at least. In accordance with this view Professor Wellhausen assumes that somewhere between the years 850-770 B.C. two narratives of the history of Israel, from the creation of the world to the conquest and settlement in Canaan, were written. One of these is called the Elohist, for the reason already indicated, and the second the Jahvistic; but which of these is the older cannot be known. Still later an author, whom Wellhausen distinguishes as the Jahvist, took the two narratives and combined them, with many additions, into a whole. The next portion to be composed was that comprised in the Book of Deuteronomy, which is supposed to be the law book introduced to King Josiah, and which formed the basis of the various reforms and changes instituted by that ruler. During the exile new ideals of worship and national life were formed by the priests and prophets, and many new enactments were added to the sacred law. In addition a new history of Israel was written in accordance with the new priestly enactments, to which Wellhausen gives the name of the Book of the Four Covenants. This book, together with the new priestly code and the Book of Deuteronomy, was finally united into a whole by Ezra, whose book, introduced in the year 414 B.C., was essentially the Pentateuch as we have it, though various additions and interpolations were made until the year 300 B.C. The composition of the Pentateuch is therefore assigned to the periods 850-770 B.C. (Jahvistic-Elohist), 621 B.C. (Deuteronomic), 573 B.C. (Ezekielic), and 414 *et seq.* B.C. (Priestley). The arguments advanced in defence of this theory are not merely based upon details of composition, but they include reasonings founded upon the history of the Hebrew nation, upon the Hebrew language, and upon a diligent study of the whole of the earlier Hebrew literature, with all that can be learned concerning the surrounding nations. It will be seen that in this theory the Mosaic authorship of the Pentateuch, or even of any part of it, is absolutely rejected; indeed the whole of the earlier history of the nation, from Terah to Joshua, is relegated to the domain of myth and fable. That some genuine historical traditions may be recognized under these myths is not denied, but the history as it stands is supposed to be entirely the invention of a very much later age. It need hardly be pointed out that this theory of the Pentateuch effects an entire revolution in the conception of the origin of the Hebrew nation, of its history, and of the history of its sacred writings previously held both by Jews and Christians. Not only so, it places the whole of the Old Testament theology in a new light, and it cannot be accepted without some serious modifications of the current theology of Christendom. Starting as it is, however, it has received some important adhesions both in Germany and England, and it is evident that while previous controversies have partaken somewhat of the nature of skirmishes, that which is now opened represents an attack upon the very citadel of orthodoxy.

Meantime it may be stated that there are yet many scholars who look with suspicion upon the whole of the various theories which, as we have indicated, have so rapidly succeeded each other, and who, in defiance of the scorn of the supporters of "the most recent criticism," yet maintain all the essential points of what we have termed the traditional theory. Certainly it is no longer contended that the Pentateuch *as we now have it* is entirely the work of Moses, or was composed under his direction; but it is maintained that its original compilation dates from his period, and that the greater portion of it was drawn up in

accordance with his instructions. It is not denied that certain anachronisms, discrepancies, differences, and obscurities exist in the Pentateuch; but it is urged that these represent only the unavoidable results of many ages of copying, and the alterations and interpolations of the scribes, and it is claimed that the whole of the later literature of the Hebrew nation presupposes the existence of such a code of laws and such a history as we have in the first five books of the Old Testament. That the worship of the nation during the period of the judges and earlier kings did not correspond to that laid down in the law is evident from the later historical books; but it is pointed out that this does not prove the non-existence of the law, for in Abyssinia to-day we have a class of priests who possess without understanding the New Testament writings, and a people who reverence them, but whose religious development offers a most striking contrast to the spirit of their sacred books.

In the course of the controversy the whole of the Pentateuch has been subjected to an examination almost

Jahs. From ancient paintings we see that a five-toned scale was used by the ancient Assyrians, and the five-stringed lyre of Abyssinia exists to this day just as we see it on the bas-reliefs of Kouyunjik or Nineveh. We also know that it was the tuning of the ancient Greek lyre before Terpander's time.

PENTECOST (Gr. *pentekostos*, fiftieth) is the Greek translation of the name given in the Apocrypha to the Jewish feast which terminated the fifty days of the Feast of Weeks. The time of the festival was calculated from the second day of the Passover, the 16th of Nisan, and the fifty days included the whole of the period of grain harvest, commencing with the offering of corn ears and unleavened bread, and closing with the offering of loaves of leavened bread, made from the finest of the wheat flour. Originally observed purely as a festival of thanksgiving for the harvest, it was afterwards made the occasion of the offering of special sacrifices and the bestowal of gratuities upon the priests. As the Paschal meal was chiefly observed as a family gathering, the Feast of Pentecost was made the

as we have referred to many of the scholars who oppose the traditional view, it may be mentioned that the latter has received the support of Hengstenberg, Havernick, Drechsler, Ranke, Baumgarten, Welte, Keil, and other continental scholars, and that an admirable defence of the orthodox position up to the period when it was written is to be found in the "Introduction to the Pentateuch," by Dr. Harold Browne, bishop of Winchester, in the "Speaker's Commentary" (vol. i., 1871). The theory of Wellhausen will be found in his "Geschichte Israels" (1878), and his "Prolegomena zur Geschichte Israels" (Berlin, 1883); translated into English by J. S. Black as "Prolegomena to the History of Israel" (Edinburgh, 1885).

PENTATHLON (Gr. *penle*, five, *athlon*, game) was considered the most beautiful of all the Greek games. It consisted of five parts, leaping, foot-racing, throwing the discus or quoit, throwing the spear, and wrestling; and the victor must succeed in all or in a large majority of them. It was a regular part of the Olympic festival.

PENTATONIC is the name given by musical theorists to those scales which have no Fourth and no Seventh of the key. Such scales would be better called *pentaphonic* if one is to be accurate in the use of words; but the other name has already got into common use, and cannot be conveniently set aside. The scale can be thus represented in its best form:—



Or it may be produced upon the pianoforte with great ease by playing on the black notes only, starting from F. This is the well-known ironical receipt for composing a Scotch tune. The reason is that much of the genuinely ancient Scotch music is pentatonic. In their present altered form the tunes contain other notes of the scale, but antiquaries are able to produce unsophisticated versions.

The reason of what to us seem omissions lies in the inability of rude ears to appreciate so small an interval as a semitone; accordingly a scale is constructed consisting of three steps of two semitones each, and two steps of three semitones each. It is evident that many varieties of pentatonic scales could be written besides that which chiefly follows our major scale, and which is given in the illustration. Such scales, varying greatly in form, are now found in use in China, Mongolia, Malacca, Java, Sumatra, New Guinea, New Caledonia, among the inhabitants of Hudson Bay, and some negroes, as, for instance, the Ful-

is now observed on two days, the days in this case being the 6th and 7th of Sivan. We do not find in the Old Testament any clear notice of the attachment of a historical significance to this feast, but most of the Jews of later times regard it as a commemoration of the giving of the law from Mount Sinai. In the Christian church Pentecost was early observed as the festival of the Holy Spirit, but this will be more appropriately considered under WHITSUNDAY.

PENTE'LIKOS (Lat. *Pentelicus*), the mountain whence the famous Attic marble was dug, material of all the magnificent sculpture and architecture of Athens and its neighbourhood. Pentelic marble was a proverbial expression in antiquity for a perfect medium of expression by art.

PENTHESIL'EA, Queen of the Amazons, fought in the later years of the war of Troy. She was slain in battle by Achilles, who when he found whom he had slain lamented loudly over the loss of so much beauty and courage. Thersites, the scurrilous tongue of the Greek camp, mocked this lamentation, and so enraged Achilles thereby that he strangled him.

PENTHEUS, grandson of Kadmos, and king of Thebes, resisted the worship of Dionusos being introduced into his kingdom. In consequence the god inspired his own women-folk with the Bacchic frenzy, and Pentheus was torn to pieces by them on Mount Parnassus, his own mother being among the murderesses. This is the subject of a play of Euripides (the "Bacchæ").

PENTLAND HILLS, a range of hills in the south-east of Scotland, extending in a north-easterly direction from the borders of the county of Lanark to the immediate vicinity of Edinburgh. Arthur's Seat, an outlier of the chain, overlooking Edinburgh, may be regarded as the termination of the range. They are chiefly composed of various eruptive rocks—greenstones, claystone, porphyry, amygdaloid, &c. The principal summits are East Carnethy Hill, 1890 feet, and Scald Hill, 1898 feet. The average height is 1000 feet. Their forms are rounded and unpicturesque. Pentland is a corruption of Pietland.

PENTLAND FRITH. See ORKNEY ISLANDS.

PENUM'BRA (incomplete shade), that portion of space which, in the eclipse of a heavenly body, is partly, but not entirely, deprived of its light. In a solar eclipse, as long as any part of the sun is visible, the parties observing are in the penumbra, and not in the *umbra*, or complete shadow.

PEN'ZA, a town of Russia, the capital of a government of the same name, is built on an eminence at the conflux of the Penza and the Soua, 350 miles south-east of Moscow. It is a flourishing town, with manufactures of cloth, iron, leather, and soap, in which, and in corn and timber, there is a brisk trade. Penza is a bishop's see, and has a gymnasium, a seminary, several convents, numerous churches, a large cathedral, and extensive government offices. The houses are all of wood, and the population is about 30,000.

PENZANCE (meaning "the Holy Headland"), the most westerly town of England, is in the county of Cornwall, situated on Mount's Bay, 8 miles from Land's End, and 327 miles from London by rail. The four principal streets meet at right angles at the town-hall and market-house in the centre of the town. This is inclosed by rugged heights which are beautiful with abundant vegetation. There is a good promenade formed by the old and new piers, which in 1882 were united by a wharf, viaduct, and swing bridge, together with an esplanade to the west of the pier. The dock accommodation has been improved in recent years. The number of vessels registered as belonging to the port in 1886 was 105 (13,500 tons). The entries and clearances each average 1800 (180,000 tons) per annum. In addition to the market-house, the chief buildings are the three churches, the custom-house, and St. John's Hall, including the guildhall, music hall, library, of 10,000 volumes, Antiquarian Society's Museum, and a fine collection of minerals belonging to the Royal Cornwall Geological Society. Large quantities of copper, tin, potter's clay, and pitchblende are exported at the pier, and early vegetables are sent to the London markets.

The mildness of the climate, and the fertility as well as beauty of the surrounding district, render it a desirable residence for consumptive invalids. The scenery of Mount's Bay is extremely fine, and on its north-east side is **MOUNT ST. MICHAEL**. Among a number of distinguished citizens, Penzance has to boast of Sir Humphrey Davy—to whom a statue is erected in the town—born here on the 17th of December, 1778. He also received his early education, and served an apprenticeship as surgeon in the town. In the neighbourhood there is a rocking stone, called "Layon Quoit" 70 feet in diameter, from the existence of which we may assume that Penzance was anciently a British town or settlement. This stone was dislodged by a nephew of the poet Goldsmith, but the admiralty ordered him to replace it. The only fact in the history of the town worth notice is that in 1595 Spaniards landed at Mousehole, 3 miles distant, burnt that village, advanced upon Penzance (from which the governor fled in a panic), and set fire to the town; but the following day the Cornish men set upon the invaders, and drove them back to their ships. During the Civil War it was taken and plundered by Fairfax for espousing the royal cause, and at the Restoration Charles II. made it one of the stannary towns as a reward for its loyalty. The town is governed by six aldermen and eighteen councillors, including the mayor. The population in 1881 was 12,409.

PEONY. See **PEONY**.

PEPER'INO, a stone of volcanic origin, used greatly by the ancients as a building stone. Ancient Rome was largely constructed of this material, as the ruins yet testify. It derived its name from some fancied resemblance to the colour of pepper (Ital. *pepe*).

PEPIN. See **PIPPIN**.

PEP'LOS (Lat. *peplum*), a woman's garment, of the beautiful costume of the ancient Greeks, translated best by our word *shawl*. It was essentially an extra garment, thrown over the ordinary dress for outdoor use, often just cast round the figure, but also often fastened, cloak-fashion, with a brooch. Brides wore it over the head, like a veil.

All the taste and skill of the ancient embroiderers were

lavished on the peplos, in accordance with its pronounced decorative character. It formed the chief garment for presentations, as, for example, votive offerings to the statues of the goddesses in the temples for preservation, from danger, &c. In some of the large temples the wealth of the peplos was prodigious, and the display on festival occasions was gorgeous in the extreme. The beautiful appearance of the peplos carelessly draped round the figure is nowhere better seen than in the famous antique statue of Thalia (the muse of Comedy) in the British Museum.

PEPPER is the name given to several pungent spices in commerce. The most important of these are derived from plants belonging to the genus *Piper* and order *Piperaceæ*. The Common or Black Pepper plant (*Piper nigrum*) occurs wild in the south-west of India, and is also cultivated in the Malay Peninsula, Java, Sumatra, Borneo, Siam, the Philippines, and the West Indies. It is a perennial climbing shrub with alternate stalked leaves, and flowers collected into stalked pendulous spikes opposite the leaves. The pepper-vine is not allowed to exceed a height of 12 feet, and is made to climb up small trees, especially those that have a rough or prickly bark. It comes into bearing in three or four years, and yields two crops annually for about fourteen years. The fruit is about the size of a pea, of a bright-red colour, sessile, and fleshy. The spikes are gathered before fully ripe, as, if the berries are allowed to ripen on the vine, they lose their pungency and fall off. The berries are spread on mats in the sun for several days, and become black and shrivelled. In this state they form the black pepper of commerce. White pepper is prepared from the same fruits, freed when ripe from the pulp surrounding the seeds by maceration in water and rubbing. White pepper is less pungent, but possesses a finer flavour; it is of a whitish-gray colour, but is frequently further bleached by chlorine.

Pepper has for long been imported from the East into Europe. Part of the tribute exacted by Attila from Rome was 3000 lbs. of pepper. In the middle ages it was a most costly spice, and rents were sometimes assessed in peppercorns. The largest quantity is imported from Penang, but that from Malabar fetches the highest price. Pepper is mainly used as a condiment. Medicinally it is sometimes used as a stimulant in cases of weak digestion. Applied externally it is a rubefacient and a vesicant. Pepper owes its pungency to a resin and its flavour to a volatile oil. It also contains a tasteless crystalline substance, *piperin*. Ground pepper is frequently adulterated with starch, sago, flour, ground rice, or linseed, all of which can be detected under the microscope.

Some of the pepper of commerce is also obtained from a nearly-allied species, *Piper trincum*. The imports of pepper into the United Kingdom in 1885 amounted to 31,657,607 lbs., valued at £970,521. The quantity exported in the same year, chiefly to various European countries, amounted to 21,691,985 lbs.

Long pepper is the fruit-spice of *Charica Roxburghii* and *Charica officinarum*. The spike consists of minute densely-crowded berries; it is gathered when unripe and dried in the sun. It is used for pickling and for culinary purposes. It is imported chiefly from Penang and Singapore. The root of *Charica Roxburghii* is used in India as a stimulant medicine, under the name of *pipili mool*.

The betel pepper-leaf is the produce of *Charica Betle*. It is used in India to wrap round the betel-nut, the fruit of a species of palms, *Arca Catechu*, which has a disagreeable flavour when eaten alone.

CUBENS are the dried unripe fruits of *Piper Cubeba* and *Piper caninum*. Red or Cayenne pepper is the produce of a species of *Capsicum*. *Jannica* pepper or *Pinketto* is derived from the dried berries of the West Indian *Eugenia Pimenta*, a species of *Myrtaceæ*. *Melagueta* pepper or **GRAINS OF PARADISE** are spices obtained from the seeds

of a West African species of *Amomum*, which belongs to the ginger family.

PEPPERMINT (*Mentha piperita*) is a species of the genus *MENTHA*, distinguished from the common *MINT* (*Mentha viridis*) by its stalked leaves, thicker and more crowded inflorescence, and larger flowers. The peppermint occurs in many damp places in England, but whether it is truly wild in this country is doubtful; it is found also in Europe, Asia, and the United States. In several parts of England, as Mitcham, Wisbeach, Market Deeping, and Ilitchin, it is extensively cultivated for the sake of the volatile oil which in common with the other mints it possesses. At Mitcham two varieties are recognized, the black and white mint. The former has a purplish stem instead of green, it flowers later, and its oil is less valued. Peppermint has an agreeably aromatic odour, and a warm, bitterish taste, followed by a sensation of cold when air is drawn into the mouth. Its properties depend upon its essential oil, which is obtained by distillation. The oil when cooled to 4° C. deposits colourless hexagonal crystals of *menthol* or peppermint camphor. Oil of peppermint is employed in medicine in flatulence, nausea, spasmodic affections of the stomach and bowels, and is frequently added to hide the unpleasant taste of other medicines. It is useful in diarrhœa. The oil is chiefly employed in the manufacture of peppermint lozenges. *Menthol* is now used largely as a remedy for neuralgia; it is chiefly imported from Japan, where it is obtained from the oil of another species.

PEPSIN, a peculiar organic compound, which in the proportion of 0.78 to 100 parts, according to Schmidt, enters into the composition of the gastric juice. The nature of pepsin is little known. It is certain that it is in the nature of a ferment, and that it differs from *ptyalin*, the ferment of saliva, by its being active in a definitely acid medium, while *ptyalin* acts more freely in one faintly alkaline. Besides, pepsin is intimately connected with the acidity of its medium. Pepsin converts proteids into peptones (which *ptyalin* does not), and herein resembles the *trypsin* of the pancreas, which, however, acts in an alkaline medium, and the special ferment of the intestinal juice.

Pepsin can be isolated by digesting portions of the mucous membrane of a stomach in cold water, after maceration in warm water (about 90°). The cold water takes up little else than pepsin, which on evaporation it throws down as a grayish-brown viscid fluid. The addition of alcohol precipitates the pepsin in grayish-white flocculi. The stomach secretes pepsin and hydrochloric acid, and the very vigorous action of the stomach depends upon the union of the two, converting the food into chyme, a pulsatious grumous semifluid mass, with a strong disagreeable acid odour and taste. See *CHYME*, *PEPTONES*.

As employed in medicine for digestive purposes, it is usually obtained from the stomach of the pig or calf by drying the fresh mucous lining of the stomach at a temperature below 100° Fahr. It then forms a light yellowish-brown powder. It is only active in a dilute acid solution; 2 grains in an ounce of distilled water, to which 5 drops of hydrochloric acid have been added, form a mixture in which 100 grains of hard-boiled white of egg will digest or dissolve in about four hours at a temperature of 98° Fahr. That prepared from the stomach of the pig, and known in medicine as *pepsina porci*, is preferred. The dose is 2 to 5 grains.

PEPTONES are a class of proteid substances produced during digestion by the action on the pepsin ferment of the gastric juice upon the nitrogenous elements of the masticated food in the stomach. The production of peptones is the main function of the digestion of the stomach. Artificially albumen peptone may be produced by diluting white of an egg, and adding to it gastric juice or pepsin obtained in the usual manner, when it will be found after

the mixture has been kept a short time at about 100° Fahr., that the albumen will no longer coagulate on boiling; and if the solution be neutralized with an alkali a precipitate of acid albumen is thrown down. If the neutralization be several times repeated till all the acid albumen is extracted there remains a considerable quantity of albumen in solution in the form of a peptone.

The main features of peptones, distinctive from other proteids, are (1) their ready diffusibility; (2) their stability as against precipitation by heat and many acids, &c., though they are thrown down easily by tannic acid and by perchloride of mercury; (3) their solubility in water and in neutral saline solutions.

It is evident that these present a remarkable series of differences in favour of digestibility. White of egg, for instance, being a colloid, is difficult of transmission through a membrane, and of course is quite insoluble when boiled, but it becomes akin to crystalloids as soon as it is acted on by the gastric juice, is easily soluble, and passes in solution through the membranous lining of the stomach into the system of surrounding bloodvessels. The precipitated portion of the contents of the stomach (answering to the acid albumen in the above experiment) are usually called *parapeptones*. It is hardly necessary to observe that as there are many sorts of proteids so are there many varieties of peptones. At present the reason of peptonic change is little known, beyond that it is of a fermentative character.

PEPUSCH, JOHN CHRISTOPHER, MUS. D., F.R.S., though so familiar to us as an English musician, was a thorough German by birth and by taste, and never thoroughly anglicized himself as did Handel, Mendelssohn, Moscheles, Benedict, &c. Dr. Pepusch was born at Berlin in 1667, his father being a clergyman there. He became a skilled musician, though almost self-taught, and as an artist his soul revolted at the brutalities of the Elector of Brandenburg (soon to become King of Prussia, in 1701), and he voluntarily expatriated himself. He arrived ultimately in England, in 1700, twelve years before Handel, and first took service in the orchestra at Drury Lane Opera. His talents soon became known, and especially his considerable knowledge (for that time) of the thorny questions involved in ancient music, so that in 1710 he was asked to assist in organizing the Academy of Ancient Music, and soon after received the appointment of organist to the Duke of Chandos, afterwards filled by Handel. Pepusch, as well as Handel, wrote Chandos anthems, but "il y a fagots et fagots." He took his degree by examination at Oxford in 1713. Shortly after he undertook the direction of the music at Lincoln's Inn Theatre, and produced there a great many masques, &c. He also composed the overture, and harmonized the tunes for Gay's "Beggar's Opera," the great popular success of the day. His reputation may be judged by the fact that the good Bishop Berkeley engaged him in the famous Bermuda project, and indeed Dr. Pepusch was one of those who actually started and were shipwrecked. In 1737 Pepusch was appointed organist to the Charterhouse, and served this office till his death in 1752. In 1747 he received the honour of a fellowship of the Royal Society for his papers on ancient music. Dr. Pepusch was friendly with both Handel and Arne, and though not comparable to either as a composer, was superior to both as a teacher. In fact the music of his pupils, Travers, Boyce, and Cook, surpasses his own work.

PEPYS, SAMUEL, who, though he filled the offices of secretary to the Admiralty and president of the Royal Society, is known chiefly as the author of a gossiping diary, was born in 1633. He was of the ancient Cottonian family of Pepys (pron. *Peps*), but his father was a tailor in London. Samuel was educated at St. Paul's School, and at Trinity College, Cambridge. At twenty-three, and seemingly without profession or occupation, he married a portionless girl of fifteen, and was content to find an asylum for

himself and his wife in the household of his cousin, Sir Edward Montagu, afterwards first Earl of Sandwich. Through Montagu's influence he obtained a clerkship in the exchequer, and when the Restoration made his patron and kinsman the Earl of Sandwich, keeper of the great wardrobe and clerk of the privy seal, Pepys was appointed (June, 1660) clerk of the acts of the navy. He was a good man of business, and whatever might be his faults he had the interest of the navy at heart at a time of shameless profligacy and jobbing in all departments of the state. He secured the esteem of his superiors, among them the lord high admiral, James, duke of York, afterwards James II. In 1673, on the resignation of the Duke of York, after the passing of the Test Act, he was appointed secretary to the navy, but was removed on an accusation of being implicated in the Popish plot, from which he was not cleared until after an imprisonment in the Tower. When Charles II., in 1681, himself undertook the office of lord high admiral, he appointed Pepys to the secretaryship of the admiralty; and the diarist retained the office, discharging its duties with energy and fidelity, to the close of the reign of James II. At the Revolution he lost his official employments, but to the end of his life was consulted, it is said, on all matters connected with the navy. He died in reduced circumstances in 1703 at Chatham, whither he had retired from London a few days before. Pepys published in 1690 "Memoirs relating to the State of the Royal Navy of England," a record of his department for the years 1678-88. He bequeathed his library and collections in reversion to Magdalene College, Cambridge, in the library of which lay unread and unknown for some fifty years the famous diary, in which day by day Pepys had recorded in shorthand the sayings and doings of nearly nine years, from 1st of January, 1660, to the 31st of May, 1669. Its value was discovered by the master of Magdalene, who had it deciphered; and, edited by his brother, Lord Braybrooke, it was published with many excisions in 1825. Several editions of it, the later with such omissions only as were required by the interests of decorum, have since been published. Its worth, historical, social, and personal, has been universally recognized, and the occasional folly and perpetual self-complacency of the diarist give its reality an amusing charm.

PER CAPITA, PER STIRPES. The distribution of an intestate's estate among persons equally is termed a division *per capita* (or by the head). If the next of kin be the intestate's brothers, A, B, and C, here his effects are divided into three equal portions and distributed *per capita*, one to each; but if one of these brothers had been dead, leaving three children, then the distribution must be *per stirpes* (or by the stock), viz., one-third to A's three children, one-third to B, and one-third to C.

PERA, a suburb of Constantinople, opposite to it, on the northern shore of the Golden Horn, and overtopping Galata, in which are situated the residences of the foreign ambassadors.

PERAK, a British protected state of the Malay Peninsula, extending along its western coast, between 3° 40' and 5° N. lat., having the English province of Wellesley on the N., Salangore on the S., and the Straits of Malacca on the W. The capital, Perak, is a small town on the river of the same name. This river offers great facilities for reaching the interior, as it is navigable for a long distance. The climate appears suitable for the cultivation of tea, coffee, cinchona, and indigo. The chief mineral is tin, of which there are vast deposits. The murder of Mr. Birch, the resident, in 1875, led to British interference and control.

PERAMBULATION. See BEATING THE BOUNDS.

PERBROMIC ACID, an acid obtained by the action of bromine on perchloric acid, and having the formula BrHO_4 ; it is a colourless oil, combining with bases, and

forming crystalline soluble salts, called perbromates. These resemble the perchlorates, and are easily decomposed, giving up oxygen.

PERCEPTION is the product of the operation of the thinking portion of the brain dealing with simple SENSATIONS. The simple sensations of roundness, of redness, of fragrance, of coolness, of a certain feeling of muscular strain in the eye, muscles, &c., tell us nothing; even a flower knows white light from coloured light as well as we. But if we group these sensations and localize them; if, for instance, we say these simultaneous sensations are referred to a certain object called an apple, distant half a yard in front of our eyes, and a foot to the left and beneath them, then we are said to perceive the apple, and the group of sensations is called a "perception," or as it now becomes more usual to say a *percept*. In the new terminology a percept is therefore an *act of perception*.

A grave distinction at once presents itself between sensation and perception, lying beyond the division into simple and compound given above, viz., that many sensations are from within, subjective, whereas perception in the strict psychological use of the word is an objective act. Even when we perceive a pain within us, that is, in some part of our body, we assume an objective attitude to ourselves in the act; we take, as it were, a position outside our body, and point to our finger or our side as the locality affected, just as we might designate localities altogether external to us. But this internal perception is only a small part of the mind's work compared to that of "external perception," the constant reference of sensations to their appropriate groups, chiefly by means of sight and touch, and the consequent recognition of objects in the world around us. So great a part do light and touch play in perception that in usual colloquial speech "I perceive" is used as synonymous with "I see" and "I feel," and *vice versa*; as when we say, "I perceive a light" or "I feel a pain in my side," where it would be perhaps more exact to say "I see a light" and "I perceive a pain in my side."

But a closer inspection shows an element in perception altogether absent to sensation and higher than it, namely, memory. For in perceiving an apple the mind recalls the similar groups of sensations frequently perceived before, and only thus is able to recognize the apple. The first perception of the apple has a very faint and vague effect upon the mind compared with subsequent perceptions assisted by memory. At last the perception of an apple grows so firmly-bound a group of sensations that the action of one sense, as smell, or sight, or taste, is enough to bring up the entire group, and we say with confidence "I smell an apple," meaning "I perceive an apple by its smell." The perception of one fruit helps the mind largely to the perception of other fruits, and so we go onward and onward through the whole external world grouping our sensations into percepts, until at last the difficulty is, with an adult of a philosophical turn of mind, to free oneself from the tyranny of this grouping, and to analyze back again the percept into its sensations. That is to say, it becomes very difficult to realize that, in the illustration given, all we really do know is the sensation of a certain odour, and that we have really not the materials for the conclusion ("that is an apple") at which we have been forced by our long experience of apples to jump. In fact, he who thinks, knows that we are perfect slaves to our "senses," as it is called—that is, to our assumptions of perceptions on imperfect evidence. Such facts form the whole stock in trade of the wonder-worker, the conjuror, &c.

It is easy and extremely interesting to watch the dawn and wonderfully rapid growth of perception in an infant—at first a bundle of sensations, unable even to turn its head towards the sound it hears, or the light it sees, not from want of muscular power, but from deficiency of perception. The touch is the great perceptive element with

the infant, especially the touch of the mouth, and everything must be handled to be really perceived, for a very long time, before the "touching age" gives way to the "seeing age," a change which varies from months to years in its occurrence with different children. Once the visual judgment obtained, however, the eye thenceforth lords it altogether over its fellow-senses as the perceiving organ of sense.

Every parent, however unobservant, must have noticed the stages at which all quadrupeds are "bow-wow's" or "pussie" all birds "cock-a-doodle-doo," all flowers "daisies;" and those later stages at which wild attempts at colour-distinctions are made, all awry as to the names, though not always really inaccurate. A child which calls a rose "blue" is often not in error as to the fact, and if asked for something else blue will quite accurately point out a red object. For the moment the names of the colours are strange and liable to confusion. It is the especial boast of the Kindergarten system of education of Froebel, that the power of perception of a child is systematically trained and developed, so that general accuracy and keenness of observation are attained at an early age, when other children have merely learned to read or to sew. It is manifest that it is possible by careful training to teach a child to distinguish one animal from another without the great waste of time which its own unaided random efforts occupy, and occupy moreover often in gaining a wrong percept after all, inaccurate or defective in some serious manner. The Kindergarten teacher never "talks," i.e. never gives the child ready-made percepts, such as, "The parrot has a rounded or hooked upper mandible," but always "asks," i.e. elicits the half-formed perceptions of the child, in such a way as, "What is the shape of this parrot's beak," and lets the answer come after due study of the living (or stuffed) specimen or of the careful drawing placed before the child. Only a very few years ago the idea of training perception was scouted as visionary, if not in words, yet in deeds, but Froebel's just ideas on this subject have now penetrated even to our Board Schools, and it already becomes antiquated even to discuss the subject which was so new yesterday. It is seen to be as absurd to stuff a child's mind with a grown-up person's percepts as it would be to teach a boy to construe Latin by setting him the English translation to learn by heart. He might learn all Homer in this way without knowing a word of Greek; and many a child has grown up under the old system comfortably possessed of the world of its parents and schoolmasters, but with scarcely the power to make one percept for itself.

Perception, then, is the basis of all knowledge, and underlies every mental operation in the last resort, each percept being itself made up of sensations grouped and localized. Perception is undoubtedly an act of the brain proper, i.e. the cerebral hemispheres—sensation being referred to the great ganglia at the base of the brain, and to other lower centres.

PERCEVAL, SPENCER, an English statesman, was the second son of John, earl of Egmont, and was born on the 1st November, 1762. At an early period he manifested a taste for politics and an enthusiastic admiration for Mr. Pitt, and during the trial of Warren Hastings he published a pamphlet to prove that an impeachment is not terminated by a dissolution of Parliament. Through his family influence he was elected for the borough of Northampton, and immediately took his place among the staunch supporters of the government. He made an able but violent attack upon Fox, took up from the first a position hostile to the claims of the Roman Catholics, and exerted himself with great ardour to suppress the Jacobin clubs and to punish their leaders. His zealous services recommended him to the notice of the king and the government, and in 1801 he was appointed solicitor-general by Mr. Addington, and in the following year was promoted to the office of attorney-

general. On the death of Pitt he retired from office along with his colleagues, and offered a strenuous opposition to the Fox and Grenville ministry which succeeded them. He was deeply implicated in the intrigues by which they were ejected from office in 1807, and was rewarded with the post of chancellor of the exchequer, to which was soon after added the lucrative office of chancellor of the duchy of Lancaster. The ill-planned and worse-managed expedition to Walcheren in 1809, followed as it was by bitter dissensions among the ministers and the resignation of Castlereagh and Canning, led to the virtual dissolution of the cabinet. The Duke of Portland resigned and soon after died, and Mr. Perceval succeeded him as first lord of the Treasury. But as the mental malady of George III. now returned with increased violence, and the Prince of Wales—whom his original connection with Queen Caroline and his conduct in the debates on the regency had deeply offended—was appointed regent, it was generally expected that the new premier's tenure of office would be very short. The prince, however, without scruple or compunction, abandoned his former associates and confirmed Perceval and his colleagues in power. He continued at the head of the government until 1812, following closely the foreign policy of Mr. Pitt, zealously prosecuting the war against France, and supporting to the last the impolitic Orders in Council which he propounded in 1808, and which in the course of four years had nearly ruined the commerce of Great Britain. On the 11th of May, at the moment this measure was under discussion, he was shot in the lobby of the House of Commons by a person named Bellingham, whom misfortunes had driven mad, and to whom he was personally unknown, and immediately expired. His personal character was unimpeachable, and he was most exemplary in the discharge of all his domestic and social duties. But his range of information was limited; he was exceedingly narrow-minded and bigoted in his political and ecclesiastical opinions, and throughout his whole career was the strenuous opponent of all tolerant and liberal measures both in Church and state. He left a very numerous family, who were liberally provided for by the legislature.

PERCH (Percidæ) is a family of fishes belonging to the order ACANTHOPTERYGII, containing many species, both fresh-water and marine. In this family the body is more or less compressed, elevated, or oblong, and covered with scales of moderate size; one or two dorsals are present; the ventrals are placed below the pectorals (thoracic); the vent is placed far forward; the mouth is without barbels; the teeth are simple and conical. The type of this family is the Common Perch (*Perca fluviatilis*, Plate, fig. 1). This fish is very common in the fresh waters of temperate Europe. In England it occurs in almost every river and lake, but in Ireland and Wales it is less common, and is almost unknown in the north of Scotland. In Scandinavia it occurs up to the sixty-ninth parallel. It is also distributed over Northern Asia and North America. The body is compressed, its height being about one-third of its whole length. Perch weighing 3 lbs. are considered to be of large size, but specimens of 8 and 9 lbs. have been taken. The upper part of the body is greenish-brown, passing into golden yellow below, the sides being adorned with from five to seven dark transverse bands. The perch prefers still waters, and feeds voraciously on worms, aquatic insects, and small fishes. It is readily taken by anglers. The flesh is well-flavoured, white, and digestible. The female is very prolific, and spawns in April or May, the eggs being deposited on water plants in long strings, joined together by a viscid matter.

Many other species belong to the family Percidæ. Other European perches are the Pope or Ruffe (*Acerina cernua*) and the Pike-perches (*Lucioperca*), the latter being found in the west of Europe. The genus *Serranus* contains sea-

perches, common in tropical and temperate seas, one species, *Serranus cabrilla*, being common on the Cornish coast. Other sea-perches belong to the genus *Dentex*, of which a Mediterranean species, *Dentex vulgaris* (fig. 2), sometimes wanders to the southern coasts of England, to the genera *Mæna* (fig. 3), *Smaris* (fig. 4.), *Pomatomus*, &c. The *BASSE* (*Labrax lupus*), a percoid common on British coasts, is noticed elsewhere. For the Climbing Perch see ANGLIAS.

PERCH, ROD, or POLE. This measure, though now mostly used as a square measure (a perch usually meaning a square perch, or a square of a perch in length and breadth), was originally a measure of length, arising out of the custom of measuring small portions of land by a rod or pole. The Latin word *pertica*, from which it comes, means a wooden staff. But the pole with which land was measured not only differed very much in various countries, but in different parts of the same country. By an early statute, entitled "Compositio Uharum et Perticarum," the perch was fixed at $16\frac{1}{2}$ feet, or $5\frac{1}{2}$ yards; and 4 perticatæ (though that word is not used) were defined as an acre. A perch is the quarter of a chain, and a square perch contains $30\frac{1}{4}$ square yards.

PERCHED BLOCKS (*Blocs Perchés*), in geology, are large masses of rock found resting upon rounded ledges and outstanding knobs on the sides of hills and valleys in districts once occupied by glaciers. Numerous examples are observed in the higher parts of Wales, in Scotland, and in the Lake District. As Sir Andrew Ramsay has remarked, these blocks "lie in places to which they clearly cannot have rolled from the mountains above, because their resting-places are separated from them by a hollow; and besides, many of them stand in positions so precarious that if they had rolled from the mountains they must, on reaching the points where they lie, have taken a final bound and fallen into the valley below." The conclusion is therefore arrived at, that as the glaciers declined in size in those particular regions, the stones they carried were let down slowly and quietly upon the surface of the rocks by the gradual melting of the ice. See also GLACIERS.

PERCHLORIC ACID. See CHLORINE.

PERCIVALE or **PARSIFAL, SIR**, was one of the Knights of the Round Table in the famous Arthurian legends which grew round that "Lancelot of the Lake" of Walter Map which is the glory of Henry II.'s reign. Map himself added to the epic of Arthur the "Quest of the Holy Graal," the cup used by Jesus at the last supper [see GRAAL], which an old monkish legend asserted had been preserved by Joseph of Arimathea, and used by him to catch the blood flowing from Jesus' side. So long as they were pure, the Knights of the Round Table, an order founded in far-off Brittany by the son of Joseph himself, watched the Graal, but when they fell as the world grew more wicked the Graal disappeared. Arthur's knights set out to try and regain it, but only the stainless Sir Galahad was able fully to see and touch the Graal.

To this great legendary epic, for Map wrote the "Mort d'Arthur" or "Morte d'Arthur" as well, and other men, both English and French, added each one his mite, Wolfram von Eschenbach a little later contributed the fine German legend of Parzival, Parsifal, or Percivale. Here there is no stainless Sir Galahad, mysteriously brought, unearthly throughout; but a man just as other men, who amid all his errors kept his ideal high, and worked out his own salvation. Such is the legend as used by Wagner for musical and dramatic purposes in an altered form in his "Parsifal" and "Lohengrin," but Lord Tennyson follows as usual the later Anglicized version, chiefly due to Sir Thomas Malory (circa 1465). In the German original Arthur is king of Brittany, not Britain; Parsifal is a descendant of Tituril, a mediæval knight, who in pursuance

of a vision of the Graal gave up his whole estate and succeeded in winning it back to earth, and in gaining its guardianship and the leadership of the original warder-knights, whom he woke from centuries of sleep by his approach. Tituril and his knights, on the onyx mountain called Monsalvat, built a circular temple to the Graal, and the cup descended and floated over the altar. A dove replenished it every Good Friday with a wafer of the Host, and thenceforth for a year it served food to the warder-knights, and balm for the wounds earned in guarding Monsalvat from the heathen. When Tituril was 400 years old he married, his age and strength remaining unaltered as at forty by virtue of the Graal. His grandson Amfortas deserted the service of the Graal, and was wounded by a poisoned spear: the Graal kept him alive by appearing to him once in seven days, but his pain was incessant. Parsifal was the nephew of Amfortas, and in the course of the usual knightly adventures in honour of distressed ladies, &c., while yet ignorant of his high birth, came into the hall of the Graal and saw the 400 knights seated there and awaiting him, and his relative Amfortas reclining among them in unceasing pain. He saw the Graal borne in from the temple by a stainless maiden, and saw the stream of dishes flow from it to form the banquet of the knights, but understood nothing of this sight, and wonderingly passed away from the castle without knowing till too late that he might have healed Amfortas, and even taken his place. Henceforth his life was spent in searching for the vanished Monsalvat. He had previously been in Arthur's court, and he now returned to it, but the terrible witch Kundry, who had cursed him as he turned from the enchanted castle of the Graal, appeared among the heroes of the Round Table and denounced him as recreant; so that Parsifal, though always quite unconscious of how he had sinned, was driven out of that company. Eventually he was led to a knowledge of religious truths by a hermit whom he encountered, and who was the brother of Amfortas, fraternally devoting his life to prayers for the king's recovery. Parsifal, now with a changed and purified spirit, quickly won his way through new adventures once more to the hall of the San Graal, and instead of remaining silent this time as before, diligently sought out and fulfilled the ceremony necessary at once to free Amfortas and secure his own succession. He was crowned by the aged Tituril, who still lived. The son of Parsifal was Lohengrin, mysterious champion of Elsa of Brabant.

The Percivale of Tennyson is a very different hero. He was one of the Knights of the Round Table of the Arthur of Britain, whose sister, a very holy nun, was privileged to see the Graal, long since disappeared because of men's sins, and now once more made visible as a reward for Arthur's high aims. Afterwards the Graal came crashing down through the roof of Arthur's great hall, and Sir Galahad saw it. The rest saw only the smoke and heard the noise. Then all the knights vowed, since the Graal had returned, to find it. Sir Percivale, after many adventures and lapses of energy from his quest, yet kept in the main true to it, and saw it at last carried away across the sea by his friend Galahad, whom he encountered at that moment. After that he wearied of the world, and retired to a monastery. Of all the rest Sir Bors alone saw it, and he but for an instant. In both cases, though the moral is not enforced, the legend is a clearly told and noble allegory—the meanings of the two, like the versions themselves, lying far asunder.

PERCOLATION, a process much employed in chemistry, especially in pharmacy, for the extraction of soluble matters from drugs and other materials. It is a method of downward filtration by a suitable solvent. The vessel employed is usually of glass or earthenware, and may be cylindrical or conical; it is furnished with a false bottom and a closed receiver to contain the percolate. The

material, to be exhausted is carefully packed in layers in the upper vessel, and the solvent is allowed to slowly percolate or filter through it. Much depends on the careful packing and preparing of the material. When very volatile solvents are employed the vessels are completely closed; in some cases, where time is an object, atmospheric pressure is brought to bear on the liquid by exhausting the air in the receiver. The British Pharmacopœia directs the use of this process in preference to maceration in many of the official tinctures and extracts. There is great difference of opinion, however, as to which method of extraction is the best; percolation in some cases is very efficient, and usually saves much time in the preparation.

The old-fashioned coffee pot is an ordinary percolator. The Napier coffee pot is an instance of a percolator acting by atmospheric pressure in connection with an exhausted flask.

PERCUS'SION, in medicine, is the method of eliciting sounds by striking the surface of the body, for the purpose of determining the condition of the organs subjacent to the parts struck. This means of diagnosis was first employed by Avenbrugger in the middle of the last century; it was afterwards extensively adopted by Corvisart in investigating the diseases of the heart; but its value, like that of all the other branches of auscultation, was not fully appreciated till Laennec made them the subject of his peculiar study. Since his time its value has been considerably enhanced by the labours of others, and it now forms one of the most valued methods of physical examination at the command of the physician. Pierry introduced the use of thin flat intervening bodies termed *pleximeters* and artificial percussors, and these are still occasionally used, but the mode most in favour at the present day is to place one finger of the left hand firmly over the point to be percussed, and to strike this with one or two of the fingers of the right hand, semiflexed, so that the tips of the fingers fall vertically upon the pleximeter finger. In this method the sense of touch assists that of hearing, and a skilled investigator often derives valuable information from the feeling in the pleximeter finger during percussion. By the labours of modern physicians the normal percussion signs of the chest have been fully investigated and described, together with all the more important variations from those caused by disease of the lungs or heart, but it requires a delicate ear and prolonged study of the sounds produced in healthy or morbid conditions of the chest or other parts before a mastery can be obtained of this method of investigation. See also **AUSCULTATION**.

PERCUSSION ACTION is a piece of mechanism often applied to the larger sorts of harmoniums; the action moves little metal hammers clothed with cloth, causing them to strike the vibrators of the harmonium as the hammers of a pianoforte strike the strings of the latter. The result is a dull, short, half-stilled metallic sound not unlike that of a banjo. In actual playing the sound thus obtained by percussion is immediately followed by the ordinary continuous sound due to the current of wind through the vibrator, the object of the percussion being to annul the momentary hesitation occurring after the key is depressed by the finger and before the wind reaches the vibrator, and therefore to permit of the performance of passages so rapid as to endanger the missing of some notes when played upon one of the ordinary stops.

PERCUSSION CAPS are small caps made of thin sheet copper containing a detonating compound of nitrate of silver. They are used for exploding charges of gunpowder in firearms, and for igniting other explosives, especially dynamite, which can only be percussively exploded.

PERCUSSION, CENTRE OF, the point of a system which moves about a fixed axis, at which a force may act in such a manner as to produce no pressure on the axis.

Its distance from the axis is the same as that of the centre of oscillation. The centre of percussion may also be defined as that point in a solid body revolving on an axis where if a force sufficiently strong shall act, it may stop the revolution of the body without imparting motion to the axis. Every solid body, though not in revolution, of course possesses a centre of percussion; and it is an accurate knowledge of the position of this point in his sword-blade which enables the swordsman to cut in half a hanging sheep, to divide a handkerchief in air, to cut asunder a stick supported by two glasses of water without braving the glasses or even spilling the water, &c.

PERCUSSION, INSTRUMENTS OF, form a large and distinctive class of musical instruments, not as a rule of the highest order, though the pianoforte, the development of the dulcimer, shows the capability of the class, and is a striking exception to the rule. Another is the clavicord, formerly preferred even to the pianoforte in its early days. Next to these drums are the most effective instruments of percussion in general use among ourselves; but bells, gongs, and harmonicons, from their greater capacity for melody, are still much in vogue among Oriental nations, where they play the part of the pianoforte among ourselves. The Java band of 1883, and the Siamese court band of 1885, brought whole orchestras of these instruments to England, and gave frequent performances. Those of the latter, given in the Albert Hall during the Inventions Exhibition, excited general admiration for their precision, though the music was scarcely capable of giving pleasure because of the strangeness of the scales in which it was set. The power of the wood and brass harmonicons was astonishing to Western minds. The Java band was completely percussive, but the Siamese added strings and wind to a limited extent. In both great use was made of gong bells struck in the midst, upon a large hollow boss, placed to receive the blow, the bells being supported on ropes in a circular bamboo frame extending all round the performer. Cymbals, castagnettes, the triangle, the ancient sistrum, &c., represent far simpler modes of obtaining musical sound, and serve among ourselves only to mark rhythm or to aid in a general clash of sound, rather than for distinctly musical ends.

PERCY. The name of an ancient and illustrious family, derived from the town of Percy in the canton of St. Lo, Lower Normandy. Descended from chieftains who aided Rollo to conquer Normandy, the barons of Percy were nobles of repute for nearly two centuries previous to the conquest of England. William de Percy (Alsgermons aux Moustaches, or William of the Whiskers), and his brother Serlo, stood high in the regard of Duke William and of his son Rufus, whom they accompanied to England. In a list preserved among the Harleian MSS. of the chieftains who served under the Conqueror in the invasion, the first name is "Dominus Percy, magnus constabularius." This was Lord William, whose share in the spoil was a barony of thirty knights' fees, situated in Hampshire, Lincolnshire, and Yorkshire. Serlo became a monk, and died in 1102, prior of the monastery of St. Hilda in Yorkshire, which he and his brother founded anew. Lord William married a Saxon lady, daughter of one of the dispossessed earls, "in discharging of his conscience." He accompanied Duke Robert in the First Crusade, and died in full view of the Holy City, at a place called Mount Joy, in 1096. With the death of his grandson William, the third lord from the Conqueror, who distinguished himself at the battle of the Standard in 1138, the first race of Percys became extinct in the male line. Two daughters, Maud and Agnes, remained to share the vast inheritance. The former married the Earl of Warwick, but died childless. Agnes married Joceline of Louvain, of the ancient house of Hainault, and brother to the queen of King Henry I. of England. The conditions of the marriage insisted upon by the

lady were, that her husband should assume either the name or the arms of Percy. Joseceline adopted the name, but retained his paternal arms, which were borne by the Percys, his descendants. Joseceline added to the great possessions of his wife the honour of Petworth in Sussex, and five and a half knights' fees in Yorkshire. His youngest son, Richard, succeeded to the headship of the Percy family, to the exclusion of a nephew, the rightful heir. Richard took up arms against King John in 1215, helped to extort the Great Charter at Runnymede, and was one of the twenty-five guardians appointed to see that it was duly observed. Dying in 1244 his possessions reverted to the true heir, Lord William, who died shortly afterwards, and was succeeded by his son Henry, who in the troublous times of King Henry III. played fast and loose with loyalty, and suffered many vicissitudes. He died in 1272, the same year as the unfortunate king. His youngest son, Henry, became the next lord, and bravely followed the banner of King Edward I. in Wales, in Scotland, and in France; was knighted by the king before Berwick, and played a conspicuous part in the battle of Dunbar (1296). He bought the barony of Alnwick, which gave a new distinctive title to the family.

His son Henry, the second Lord Percy of Alnwick, supported Queen Isabel against her unhappy husband, Edward II., and subsequently enjoyed the confidence of Edward III. He was at the memorable battle of Halidon Hill (1333), in which the Sea's suffered a total defeat, and overcame them again at Neville's Cross (1346), where David Bruce, king of Scotland, was taken prisoner. He died in 1352, and was succeeded by his son Henry, who had already gained his laurels at the battle of Cressy, 1346. This third Lord Percy of Alnwick, as warden of the marches, had much to do in the affairs of Scotland. He became allied to the royal family by marrying Mary Plantagenet, daughter of Henry, earl of Lancaster, who was grandson of King Henry III. The two sons of this nobleman, Henry and Thomas, both became eminent. The latter, for his great services by sea and land, in peace and war, in France and elsewhere, was created, in 1397, Earl of Worcester, by Richard II., who also made him admiral of the fleet, and bestowed other favours upon him. Nevertheless on that king's deposition Worcester accepted office under King Henry IV. (Bolingbroke), who strove, by conferring benefits, to gain his esteem and confidence. Commiseration for his old master may have influenced Worcester, when in 1403 he joined his brother and nephew in that insurrection which terminated so fatally for them at the battle of Shrewsbury. Worcester was taken prisoner and beheaded at Shrewsbury.

Henry Percy, the elder brother, was created Earl of Northumberland at the coronation of Richard II., 1377. He incurred much public odium, and some danger, from the favour he showed to the person and doctrines of John Wyclif the reformer. A difference between him and John of Gaunt occurred in 1382 at Berwick, and was never entirely healed. Suspicions of Northumberland and his son Henry, surnamed, from his prowess in the field, Hotspur, were instilled into the mind of the king, Richard II., who on his departure into Ireland in 1399 confiscated their estates, and proclaimed them traitors. This arbitrary act precipitated the revolution which has been called the conspiracy of the three Henrys—Bolingbroke, Northumberland, and Hotspur—and which terminated in the accession of Henry IV. to the throne. The services then rendered to King Henry were too great ever to be adequately rewarded. Northumberland was constable of England, and his power and authority threatened to overshadow the throne. In 1402 the Percys gained over 12,000 Scots, under Douglas, the victory of Homildon, at which Douglas and other men of mark were taken prisoners. The king desired to have a share in the ransom of these prisoners, at which Hotspur was very indignant. Hence the rupture between the Percys

and the king, which led to the revolt, defeat, and death of Hotspur in the battle of Shrewsbury. Earl Percy having been at the time detained by illness at Berwick, disavowed the insurrection, and made his peace with Henry. He survived but to conspire again against the hated prince whom he had placed on the throne. He was forced to flee from his domains into Scotland, thence into Wales, which he quitted for the Continent; where collecting an insufficient force he made a descent upon England, and was slain in a conflict on Bramham Moor, near Weatherby, 1408. His gallant son Hotspur was the hero of that victory over the Scots at Otterbourne in 1388, which has been rendered so widely celebrated by romantic ballads.

Hotspur's son, Henry, second earl of Northumberland, was educated in Scotland, whither he had fled with his grandfather. Being reinstated in his honours and estates by King Henry V., he remained faithful to the Red Rose, though of near kindred to the Duke of York. He was raised to the dignity of constable of England, and fell fighting for the house of Lancaster at the battle of St. Alban's, 1455. The romantic circumstances attending the marriage of this earl form the subject of a poem entitled "The Hermit of Warkworth."

Of his twelve children four sons were eminent leaders of the Lancastrian party, and died on the field of battle. Sir Thomas, created Baron Egremont, was slain at Northampton in 1460; Sir Ralph in 1464, at Hedgeley Moor, where he fought against great odds, comforting himself in his death with the reflection "I have saved the bird in my bosom," meaning his fidelity to Queen Margaret and her son. Sir Richard, who with Egremont began the civil war in 1452 by a pitched battle at Stainford Bridge with two of their cousins, the Nevilles, was killed in 1461 on Towton field, where also fell at the same time his elder brother Henry, the third earl of Northumberland, who had borne a leading part in all the transactions of that troubled time.

Henry Percy, fourth earl of Northumberland, his father having been attainted and the earldom given to a Neville, was confined in the tower till 1469, when King Edward, jealous of the Nevilles, restored Percy to his rank and possessions. The oath of fealty which Percy then took was faithfully kept; yet at the battle of Bosworth, though he appeared on King Richard's side, he and his followers observed a neutrality, which seemed to the earl the favour of King Henry VII. The death of this earl took place in 1489, when he was attacked by the populace in his house near Thirsk for his supposed share in the enforcement of an obnoxious tax insisted on by the king.

Henry Algernon Percy, fifth earl, was only eleven years old when he succeeded his father. He was high in the favour of King Henry VII. and Henry VIII., and was celebrated for his magnificence, taste, and patronage of learning. He died in 1527. Of his sons, Thomas, the second, was executed at Tyburn in 1537 for his share in Aske's rebellion, or the Pilgrimage of Grace. Henry Algernon, the eldest son, became sixth earl of Northumberland. He served in the suite of Cardinal Wolsey, made love to Anne Boleyn, and was secretly betrothed to her when there was no expectation of her becoming queen. It fell to his lot to arrest Cardinal Wolsey at Cawood House, near York. His extravagance procured him the nickname of "Henry the Unthrifty." Unhappy in his marriage and childless, and with a broken constitution, he did not survive the execution of his brother many days, dying on the last day of June, 1537. With him the peerage of the house of Percy became extinct, and their title was conferred by Edward VI. upon Dudley, earl of Warwick. Queen Mary, however, in 1557, restored the title and possessions to Thomas Percy, the son of him who had suffered at Tyburn for his zeal in the Catholic cause. This seventh earl of Northumberland was an able commander, and did good service to both Queen Mary and Queen Elizabeth in Scot-

land and elsewhere. Jealousy of Cecil, and indignation at the claims of the crown to a copper mine found on his estate, led him to the rebellion in which he engaged with the Earl of Westmorland. Northumberland had to flee to Scotland, where he was betrayed into the hands of the Regent Murray, and imprisoned in Lochleven Castle. He was afterwards given up by Morton to Lord Hunsdon, and beheaded at York on 22nd August, 1572. Four years afterwards his brother, Sir Henry, was summoned to Parliament as the eighth earl. He had previously distinguished himself in Scotland, and stood loyal to the queen at the time of his brother's defection. Nevertheless, he was suspected of intriguing with the friends of Mary Queen of Scots, and committed to the Tower, where on Monday, 21st June, 1585, he was found dead in his bed, shot with three bullets, his door being barred on the inside, and a pistol found in the room.

He had eight sons, the eldest of whom, Henry Percy, succeeded him as ninth earl, and distinguished himself by joining, in a ship fitted out at his own charge, the fleet with which Lord Howard opposed the Invincible Armada. As a staunch supporter of the Stuart family this earl was at first greatly favoured by James I. until the discovery of the Gunpowder Plot, in which Thomas Percy, a relation of the earl's, was a principal conspirator. Though a Protestant the earl thus "smitted with the Gunpowder Plot," was tried by the Star Chamber, fined £30,000, and cast into the Tower, where he spent fifteen years amusing himself with those astrological studies which acquired for him the name of "Henry the Wizard." He died at the age of seventy in 1632.

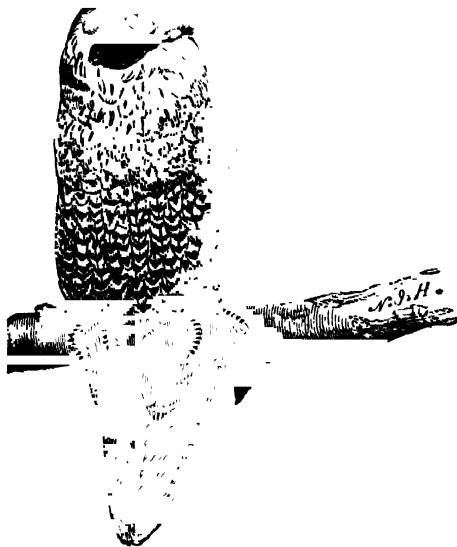
His younger son, Henry, created Lord Percy of Alnwick, was a staunch Cavalier, faithful to the Stuarts in weal and in woe; while Algernon, the elder son, and the tenth earl of Northumberland, after having held the office of lord high admiral, and commanded an army for Charles I. against the Scots, took the side of the Parliament on the breaking out of the Civil War. He withdrew from public life on the execution of the king, and died in 1668, and was followed to the grave two years afterwards by his only son and heir Josceline, the eleventh and last Percy, earl of Northumberland, who died of a fever at Turin in 1670, aged twenty-six. His only child and heiress, Lady Elizabeth Percy, was thrice married and twice a widow before she was sixteen, when she became Duchess of Somerset.

PERCY'S RELIQUES, a famous collection of old English ballads, published in 1765, and due, like Ossian's poems [see MACPHERSON] and the Rowley forgeries [see CHATTERTON], to that sympathy with the past, though with a very limited critical understanding of it, which dignified the latter half of the last century, was the work of Thomas Percy, afterwards bishop of Dromore. We know now that Percy, while not a mere forger of genius, like Chatterton, nor an amplifier of grandiose fragments of genuine antiquity, like Macpherson, was very far from the high standard of antiquarian honour which is now demanded. He cut out from and added to his ballads as he thought fit, and retouched them out of knowledge. Nevertheless, conventionalized and modernized as they were, the "Reliques" were a substantial gift to England, and while wrong in themselves served to set others on the right path. As for the collector himself, Thomas Percy was born in 1729, and died in 1811. He was the son of a grocer at Bridgnorth; went up to Oxford with an exhibition from the local grammar-school, and received a college living at Easton Mauduit, Northamptonshire, in 1753. His greatest prize was a folio MS. collection of ballads of early Stuart date, and he added others diligently, editing (and altering) the whole in his published work, under the well-known title, in 1765. He was chaplain to the Duke of Northumberland, and by the duke's exertions became dean of Carlisle in 1778. In 1782 he received the see of Dromore in Ireland. Dr. Percy was also

the first to direct attention, by his translation of Mallet's "Northern Antiquities" (1770), to the antiquities and characteristics of the grand Scandinavian mythology. His death occurred at Dromore on the 30th September, 1811. To the reader of Boswell it will be superfluous to state, that Dr. Percy enjoyed the friendship of Johnson, Goldsmith, and the most distinguished men of his day.

PERDIK'KAS, son of Orontes, was the trusted general of Alexander the Great. When the king lay dying, and no one knew what was to become of the vast empire he had founded, he drew his signet ring from his finger and gave it to Perdikkas, thereby constituting him regent. The other great generals divided the rest of the territory, leaving Perdikkas, Macedonia and Greece to rule in the name of Arrhidaïos, son of Alexander. But Antipater and Ptolemy, dreading his ambitious schemes, determined to break his power. Perdikkas took the offensive, left one army in Asia Minor and marched with another into Egypt. He found the passage of the Nile barred by fortifications, which he was unable to break through, and his troops were so discouraged by his repeated attempts and the fruitless slaughter that resulted, that they rose in a body and murdered him in his tent.

PEREGRINE FALCON (*Falco peregrinus*) is a species of FALCON inhabiting almost all parts of the world. It is found throughout Europe, except Spitzbergen and



Peregrine Falcon (*Falco peregrinus*).

Iceland, in Northern and Central Asia, Northern Africa, throughout North America, and as far south as the Argentine Confederation. In Britain it breeds on many parts of the coast, from the Isle of Wight to the Orkneys and Shetlands, being most abundant in the north; but in the greater part of England it is best known as a migrant, and is observed chiefly in autumn.

The peregrine falcon usually measures from 15 to 18 inches in length; the plumage of the top of the head and the back of the neck is nearly black, and a spot of the same colour occurs on the cheeks beneath the eyes; the back is of a bluish-ash colour, with darker bars; the primaries are brownish-black, with whitish spots on the inner webs; the front of the neck is whitish, spotted with brown, and the

rest of the lower surface grayish-white, with numerous dark brown bars; the beak is blue, with a blackish tip and a yellow cere; the feet are also yellow, with acute black claws.

From its strength of wing, daring, and docility, the peregrine held the first place in the old sport of *FALCONRY*. The female, which is larger than her mate, was most valued by the old falconers, who gave to her alone the name *falcon*. She was flown at quarry of large size, such as herons, ducks, and wild geese. The male of the peregrine was called *tiercel* (sometimes corrupted into *tassel*), a name which is commonly explained as meaning that the male was one-third smaller than his partner; but, according to Professor Schlegel, the name was given from the old belief that each nest contained three young birds, of which two were females and the third and smallest a male. When *falconry* flourished as a sport enormous sums were paid for a cast of peregrine falcons, and both birds and their nests were protected by legislative enactments. Now, for various reasons, this old sport has almost disappeared, and seems doomed to final extinction.

In a wild state the peregrine falcon tyrannizes numerically over all the weaker part of the feathered creation. In most districts grouse and partridges seem to constitute its favourite food, and it is at such game as this that the male or tiercel is trained to fly; but when the peregrine has its dwelling-place in the vicinity of water frequented by aquatic birds, it preys freely upon these, pouncing down upon them while swimming peacefully on the surface of the water, and carrying them off in its talons with the most astonishing address. Rabbits and leverets are also frequently destroyed by these falcons. Their boldness is such that they have even been known to strike grouse sprung by the sportsman's dogs before the birds had risen high enough to be shot at, and in several cases wounded birds have been carried off by them.

The peregrine falcon usually builds its nest among the nearly inaccessible rocks and cliffs of the sea-coast, but is also known frequently to select an inland station for this purpose. The nest, which is composed of sticks and dried plants, is a bulky structure, and in it the female lays three or four eggs, of a dull light-red colour with darker spots.

PEREKOP' (meaning rampart), a town of Russia, on the isthmus of the same name, 85 miles N.N.W. of Simpheropol, in the Crimea. Salt abounds in the vicinity; and a rampart of little strength crosses the isthmus at its narrowest point—5 miles broad. The town is of little importance, except as a military post, and the inhabitants suffer severely from intermittent fever, the situation being very unhealthy and singularly depressing.

PERENNIAL, a botanical term employed to designate plants which exist for more than two years, though their stems may flower and perish annually. The term is generally applied only to herbaceous plants.

PEREZ, ANTONIO, for some years the favourite minister of Philip V. of Spain, and then the victim of his unrelenting hostility, was born about 1541, and succeeded his father, who had been for forty years secretary of state, in his office. Don John of Austria, an illegitimate son of Charles V., was in 1576 commander of the army of the Netherlands; and Philip, with a view to control his movements, appointed Juan de Escovedo to be his secretary. The sequel is one of the most intricate passages in history; but there appears to be no doubt that Philip was led to believe that Don Juan was meditating an attempt to make himself sovereign of the Low Countries, an alliance with England, and possibly an invasion of Spain, and that Escovedo was an active agent in carrying out these designs. Under this belief, the king authorized Perez to procure the assassination of Escovedo. An attempt was first made to poison him, which failed, and one of Escovedo's servants was hanged for the crime. Failing this, on the 31st

March, 1578, Escovedo was mortally stabbed in a street of Madrid by one of four ruffians engaged by Perez, all of whom escaped and were rewarded, but the two principal culprits died soon afterwards, not without suspicion that they had been poisoned by order of Perez. M. Miguet, who has published a volume on this incident, based on many documents never before brought to light, deems it conclusively established that the accusation of treason against Don Juan was unfounded, and that Perez determined to destroy Escovedo, and to shield himself by making the king an accomplice, for another reason. The motive, which he considers almost proved, was that Escovedo had detected an intrigue between Perez and the Princess Eloli, the king's mistress, and feared the consequences of the disclosure. Certain it is that Philip, yielding to the entreaties of the relatives of the murdered man, caused Perez to be arrested four months afterwards. The prosecution lingered until all the important witnesses were dead. A prosecution for alleged corruption was instituted, he was sentenced to two years' imprisonment, eight years' exile, and a heavy fine. Then, all the papers which proved the king's complicity having been, as was supposed, recovered, the graver charge was pushed forward; Perez was put to the torture and confessed the murder, but accused the king of having been privy to it. Finding that his fate was determined on, he contrived to escape from prison and reached Aragon, where the ancient constitution secured him a fair and public trial. Philip endeavoured to overawe the popular feeling in favour of the ancient privileges, but an insurrection was the consequence. Then, on an absurd charge of heresy, he caused Perez to be seized by the officers of the Inquisition; but the Saragossans rose again and liberated the prisoner, who escaped to France. Even there several attempts were made to murder him, at the instigation of the Spanish government. Perez afterwards visited England, and enjoyed the friendship of the Earl of Essex, Francis and Anthony Bacon, and other distinguished men. He died in Paris in 1616 in great poverty.

PERFUME denotes either an odoriferous emanation from a body creating a pleasant impression on the olfactory nerves, wherein resides the organ of smell, or the body itself whence this emanation proceeds. The name is derived from two Latin words, *per fumum* (through smoke), because the first perfumes were obtained from the combustion of aromatic woods or resins.

Perfume is both invisible and imponderable. The most minute investigations have not succeeded in proving that its emission lessens in any way the weight of the body which gives it out. A single pod of musk was found to have discharged in one day 57,000,000 particles in a radius of 30 yards, without having lost an atom. The process of extracting the aroma of flowers tends to show the same result, for although the concrete essence it produces seems from its intensity of flavour to be the solidified principle of scent, all its odour may be removed by infusion in alcohol without diminishing its weight in the slightest manner.

It might be concluded from the above fact and the unanalyzable nature of perfume, that it is not a gas, but simply a dynamic action of the odoriferous substance which strikes the sense of olfaction by means of waves of scent, in the same manner as the light strikes the eye or sounds the ear. This is, however, a very abstract theory, which has led to a great deal of controversy without eliciting hitherto any satisfactory solution.

Perfumes are evolved principally by bodies belonging to the vegetable kingdom, such as flowers, plants, rhizomes, bark of trees, gums, &c.; the animal kingdom furnishes but three available specimens—musk, civet, and ambergris. The first of these substances is found in a pod under the belly of the male musk deer (*Moschus moschiferus*), civet is a secretion of the civet cat (*Viverra civetta*), and

ambergis is ejected by the large-headed whale (*Physeter macrocephalus*).

Odours can become fixed into other bodies with which they come in contact, and on the degree of affinity which exists between them may be said to rest the principles of the art of perfumery.

Perfumes exercise a cheering and exhilarating influence on the system, and revive the nerves when fatigued or depressed. "Ointment and perfume rejoice the heart," say the Scriptures (Prov. xxvii. 9), and, in fact, owing to the close connection which exists between the olfactory organs and the brain, perfumes produce an agreeable and beneficial effect on the mind, and procure the most pleasurable sensations. They especially refresh memory, and a spot that we have visited, or some circumstance in our life, will be often recalled to us by some particular odour. Even when sleep has bereft us of most of our faculties, perfumes preserve their action on our confused ideas, and are capable of influencing our dreams. (Dr. Cloquet's "Traité d'Osphresnologie.")

Odours have been classified in various ways by scientific men. Linnaeus divided them into seven classes, three of which only were pleasant odours, viz. the aromatic, the fragrant, and the ambrosial; but however good his general divisions may have been, the above were far from correct, for he classed carnation with laurel leaves, and saffron with jasmine, than which nothing can be more dissimilar. Fourcroy divided them into five series, and De Haller into three. All these were, however, more theoretical than practical, and none classified odours by their resemblance to each other. A new classification is now generally adopted, comprising only the various odours used in perfumery, and based upon the principle that as there are primary colours from which all secondary shades are composed, so also are there primary odours with perfect types, and that all other aromas are connected more or less with them and can be obtained by the combinations of those primary odours.

PERFUMERY, HISTORY OF. The origin of perfumery, like that of all ancient arts, has been the subject of great controversy. Some assert that its birth-place was Mesopotamia; others Elam, or ancient Persia; others again Arabia, which has long enjoyed and still retains the name of the "Land of Perfumes." It is, however, certain that the first perfumes were obtained by the combustion of aromatic woods and gums, and that the first use primitive nations made of them was to offer them on the altars erected to their gods, perhaps with the mystic idea that their prayers would reach them the sooner, being wafted on the blue wreaths of smoke which they saw slowly arise and disappear in the air; or for the less poetical purpose of counteracting the smell of the flesh burned in their sacrifices.

The first mention of perfumes we find in the Scriptures, is when Joseph was sold by his brothers to some Ishmaelite merchants who came from Gilead with their camels bearing spicery, balm, and myrrh to Egypt (Gen. xxxvii.). At that time, although Judea abounded in fragrant plants and flowers, as mentioned by Strabo, Theophrastus, and other ancient authors, the Jews do not appear to have used them except for the purpose of commerce; but when they returned from their long captivity in Egypt they brought with them some of the luxurious habits of their late masters, and among others that of using perfumes. It was thus that the altar of incense was erected; and Exodus gives us full particulars of the component parts of their sacred perfume and of the holy oil which was used to anoint the tabernacle, the holy vessels, and the altars, and which was also poured on the head of Aaron as high priest. The holy incense consisted of equal parts of stacte, onycha, and frankincense. The anointing oil was a mixture of myrrh, cinnamon, calamus, and cassia, dissolved in holy

oil. Those two preparations were to be strictly confined to sacred purposes, and persons employing them for private uses were cut off from the people. It was also strictly forbidden to any but the descendants of Aaron to offer incense before the Lord, and Korah, Dathan, and Abiram, with 250 others, were burned for having violated that law (Num. xvi.). Uzziah the king was likewise reprimanded by Azariah the priest for attempting to burn incense in the temple, and having persisted in his design was struck with leprosy on the spot (2 Chron. xxvi.).

The ancient Egyptians made a great consumption of perfumes for offerings to the gods, embalming the dead, and use in private life. In all the temples of their numerous deities incense was constantly burning, and on grand state occasions the king himself officiated, holding a censer in one hand and in the other a vial full of scented oil to anoint the statue of the god. At Heliopolis, the city of the sun, where that god was adored under the name of Ra or Phre, they burned incense to him three times a day; resin at his first rising, myrrh when in his meridian, and a mixture of sixteen ingredients called *kuphi* at his setting. The Egyptians entertained great veneration for the dead, and in order to be able to keep the bodies of their departed ancestors in their houses, and pay them due honours, they had recourse to aromatics, of which they had ascertained the preservative properties.

The Greeks, being a highly refined nation, were naturally great admirers of perfumes. Not only did they offer them in their religious ceremonies, as an homage due to their gods, but they also looked upon them as a sign of their presence. Homer and the other great Greek poets never mention an apparition of the gods without speaking of the heavenly ambrosial fragrance they shed around them. Perfumes were also lavishly employed in private life, and their consumption increased at one time to such an extent that Solon thought it necessary to forbid the Athenian people from using them. We may suppose, however, that this law was not long observed, for the Athenians were still celebrated in the time of the Roman Empire for their talent in making up perfumery. Their principal perfumes were unguents, and the most famous was the *panathenæon*, of which Athenæus gives the formula. They also used various aromatics for burning at their festivals or private entertainments, and dry perfumes for scenting their clothes, a custom as ancient with them as the time of Homer (Iliad, 21), and still prevalent among the modern Greeks. Odoriferous herbs and spices were likewise burned with the bodies of the dead, and perfumes were poured on their ashes. Perfumes were also used by the ancient Greeks to flavour wines, which was supposed to render them beneficial, as well as more agreeable. Athenæus mentions one of these wines called "sapria," which was made by infusing in it roses, violets, and hyacinths. Although applied to a different purpose, this may perhaps be looked upon as the first step to alcoholic perfumes.

The Romans carried the art of perfumery to great perfection, and their productions were as numerous, if not as excellent, as those of modern perfumers. Pliny, Dioscorides, Galen, and other authors give the fullest particulars on this subject. In the early times of the Roman monarchy the use of perfumes seems to have been confined to sacred purposes and funeral rites, but at the close of the republic, and still more under the empire, the gradual increase of luxury gave a great impulse to the production of perfumery. An edict was issued towards the close of the republic to prohibit the sale of exotic perfumes. They were already used at that time in such profusion, that Lucius Plantius, after being proscribed by the triumvirs, was betrayed, in his place of concealment at Salernum, by the smell of his unguents. At a later period Nero consumed, at the funeral of Poppæa, more aromatics than

could be produced by Arabia in a twelvemonth, and in a feast given to him by Otho, gold and silver pipes shed costly perfumes around the hall during all the time of the entertainment.

There were three kinds of perfumes principally used—*hedysmata*, or solid unguents; *stymmata*, or liquid unguents having an oily basis; and *diapsamata*, or powdered perfumes. The unguents formed a numerous class, and their names were borrowed, some from the ingredients which entered into their composition, some from the original place of their production, and others, again, from the peculiar circumstances under which they were first made. Like our present preparations, they succeeded each other in public estimation, and novelty was as great an attraction to the Roman belles as it is to our own modern ladies. There were the simple unguents, flavoured with one aroma, such as the *rhodium*, made from roses; the *crocinum*, from saffron; the *melinum*, from quince blossoms; the *myrtinum*, from bitter almonds; the *narcissinum*, from narcissus flowers; the *malobathrum*, prepared from a tree so called by Pliny (supposed by some to be the *Laurus cassia*), and many others too numerous to mention. The compound unguents were prepared by combining several ingredients together. The most celebrated were the *susinum*, a fluid unguent made of lilies, oil of ben, calamus, honey, cinnamon, saffron, and myrrh; the *nardinum*, made of oil of ben, sweet rust, costus, spikenard, annomum, myrrh, and balm; and above all, Pliny praises the regal unguent, which was originally prepared for the king of the Parthians, and which consisted of no less than twenty-seven ingredients (Pliny's "Nat. Hist.," xiii. 2). Some of these preparations were very costly, and sold for as much as 400 denarii per pound, or about £14. The Romans not only applied them to the hair, but to the whole of the body, even to the soles of their feet. The most refined, indeed, adopted a different perfume for each part of their person. Besides this, their baths, their clothes, their beds, the walls of their houses, and even their military flags, were impregnated with sweet odours. Some carried that taste so far as to rub their horses and dogs with perfumes. In addition to the unguents named, the Roman ladies made use of numerous cosmetics to increase their beauty, and they attached so much importance to that branch of their toilet that they had some slaves called *cosmetæ*, whose special duty was to apply those preparations. Some of those cosmetics consisted of pea flour, barley meal, eggs, wine lees, hartshorn, bulbs of narcissus, and honey; others simply of corn flour or crumb of bread soaked in milk. They made with those pastes a sort of poultice, which they kept on the face all night and part of the day. The perfumers of Rome (called *unguentarii*) were very numerous, and occupied a quarter of the town named *Vicus Thurarius*, in the *Velabrum*. They were principally Greeks, and their shops were the common resort and meeting-place of the fashionable loungers.

Avicenna, an Ara-^{bian} physician who flourished in the tenth century, was the first to study and apply the principles of chemistry, which were but imperfectly known to the ancients. He is supposed to be the inventor of distillation, and naturally applied his discovery to the extraction of the many fragrant treasures with which his native country was gifted. Rose water was one of his first productions, and it was soon made in such quantities that when Saladin entered Jerusalem in 1187, he had the floor and walls of Omar's mosque entirely washed with it.

Among modern nations, France and Italy were the first to resume the use of perfumes. In the Catholic churches they not only burnt incense, as they do now, but they used fragrant tapers to perfume the air at all grand ceremonies, and we find that such was the case at the baptism of Clovis, the first Christian king of France, in the year 496. Perfumes were also consumed in private life at an early period,

and Charlemagne is said to have been very partial to them. The intercourse brought about between the West and the East by means of the crusades was also instrumental in introducing the use of perfumes into Europe. In the year 1190 Philip Augustus granted a charter to the master perfumers, which was confirmed by John in 1357, and later by Henry III. in 1582. That charter was for the last time renewed and enlarged by Louis XIV. in 1658. It was then requisite to serve four years as apprentice and three years as companion to be elected master, which shows it was already considered a handicraft of some importance. Their preparations were at first very simple, such as aromatics to burn in apartments, various unguents, and rose water, which was always offered by noblemen to their guests at table. Acoholic perfumes were not made till about the fourteenth century, and the first we find mentioned is Hungary water, distilled from rosemary, which, according to some authors, was prepared in the year 1370 by a queen of Hungary named Elizabeth, who had the recipe from a hermit, and became so beautiful through the use of it that she was asked in marriage at the age of seventy-two by the King of Poland.

When Catherine de Médicis came to France to marry Henry II., she brought with her a Florentine, named René, who was very expert in preparing perfumes, for the Italians were then more advanced than the French in that art, and from that time perfumery came into general use among wealthy people. This René also possessed the art of preparing subtle poisons, and his royal mistress is said to have had frequent recourse to his talents to get rid of her enemies. Among her victims the historians mention Jeanne d'Albret, mother of Henry IV., and state that she was poisoned by having worn some perfumed gloves presented to her by Catherine, but modern chemists doubt whether it was possible to effect such a mode of assassination. From that time the French taste in perfumery went on progressing; and at the court of Louis XV. etiquette prescribed the use of a particular perfume for each reception-day, which caused it to be named the "perfumed court." Since then the advance of civilization and public welfare has rendered the use of perfumery general in all ranks of society, and France has now become the chief mart of that article for all parts of the world.

In England perfumes were first imported from Italy and France, and came into great vogue during the reign of Queen Elizabeth. Shakspeare often mentions musk, civet, perfumed gloves, and pomander, or *pommes d'ambre*, which were balls of perfume, to be held in the hand and smelt occasionally; the latter were supposed to preserve from the plague. It is difficult to ascertain the precise date when manufactories of perfumery were first established in England, as perfumers did not form here a separate corporate body as they did in France; but an old English recipe book, printed in 1663, contains a dentifrice prepared by M. Ferene, of the New Exchange, perfumer to the queen, so that they had already at that time begun to manufacture. Since that period the perfumery trade of England has followed about the same progress as that of France, until it has reached its present state of prosperity.

Perfumery is now divided into two distinct branches: the preparation of perfumery materials, which chiefly takes place in France, Italy, Spain, Turkey, India, Algeria, and other warm countries; and the manufacture of perfumes, cosmetics, and toilet soaps for general use, which is carried on in the principal cities of Europe, but especially in London and Paris.

PERFUMERY, PROCESSES OF. There are four means in use among modern European perfumers for extracting the aroma from fragrant substances: distillation, maceration, absorption, and expression.

Distillation, which is applied to plants, seeds, barks, woods, and a few flowers, consists in placing the substance from

which the scent is to be extracted in a copper vessel called a still, with enough water to cover it. Heat is applied, and the steam generated, which is impregnated with the fragrant molecules, passes through the head of the still into the worm (a coiled pipe placed in a tube, where it becomes condensed by means of the surrounding water, which is constantly kept cool), issues in liquid form at the tap, and flows into the recipient. If sufficiently loaded with aroma it then separates into two parts, the most concentrated of which, called the essential oil, collects either on the surface or at the bottom, according to its specific gravity. It is then decanted, and the water used again for distilling, unless it is of sufficient value in itself to be saved, as is the case with rose and orange-flower water. The recipient is constructed in such a way as to allow the water to escape while retaining the essential oil.

Various attars, or essential oils, are made in India from native fragrant flowers, principally at Glazepore, on the banks of the Ganges. Besides the rose, they distil several sorts of jasmine, the kōrā or panding (*Pandanus odoratissimus*), the champac (*Michelia champaca*), the kurna (*Phanie ductilifera*), the bookool or maulsuri (*Mimosa elengi*), and the blossoms of the henna (*Lawsonia inermis*). These essential oils are made in very primitive clay stills; the distillate is left to stand over night in open vessels, and the oil is skimmed off in the morning. They would be very beautiful if they were not spoiled by the admixture of sandal-wood shavings, which facilitates distillation, but gives them all the same heavy flavour.

The fragrant principles of all aromatic plants may be extracted by distillation, in the shape of essential oil; in fact, it exists ready formed in many of them, contained in minute vesicles, as you may see by bruising a thyme or rosemary leaf with the hand. Such is not the case with flowers; the aroma they possess, with a very few exceptions, is so fugitive that it would become destroyed in the process. In that case maceration or absorption is resorted to.

Maceration consists in steeping flowers in a bath of hot grease, letting them infuse, and renewing them until the grease is completely saturated. This grease, which is called *pomade*, is then submitted to strong pressure in horse-hair bags. Oil is also perfumed in the same way, but requires less heat. This process is applied to rose, violet, cassia, jonquil, and orange flowers; but for more delicate flowers, such as jasmine and tuberose, the *absorption* or *enfleurage* system is employed. Purified grease is spread in a thin layer on a pane of glass mounted in a wooden frame or sash, called *chassis*; fresh flowers are strewn over this grease, and renewed every morning; and at the end of two or three weeks this grease or pomade acquires the scent of the flower in a high degree. Perfumed oil is made in the same way by substituting a wire bottom to the frame, and spreading on it a thick cotton cloth, steeped in the finest olive oil, which is pressed out of it after complete saturation. These frames are piled on each other to keep them hermetically close.

These two processes, of maceration and absorption, are founded on the affinity which fragrant molecules possess for greasy bodies. Thus the aroma of flowers is first transferred to these pomades, which are made afterwards to yield it to alcohol, while the latter, if placed in direct contact with the flowers, would not extract it from them. These alcoholic extracts form the basis of the finest perfumes, as they possess the true scent of the flower in all its freshness and delicacy. The best are made from pomades, those made from oil retaining a slightly oily flavour which is not agreeable.

M. Millon, an eminent French chemist, discovered another mode of extracting the aroma of flowers by placing them in a percolating apparatus and pouring over them sulphuret of carbon or ether. The liquid is then placed in a still, and the sulphuret of carbon or ether evaporates, leaving

a dry waxy residue which possesses the aroma of the flower in its most highly concentrated form. This process has not yet received a practical application, owing to the expense attending it, as it requires an immense quantity of flowers to make a single ounce of these concrete essences.

The number of flowers used for perfumery purposes has hitherto been limited to seven, viz. rose, jasmine, orange, violet, jonquil, tuberose, and cassia. The rose used is the hundred-leaved rose (*Rosa centifolia*), the jasmine is the *Jasminum grandiflorum*, the orange is the bitter orange (*Citrus bigaradia*), and the violet the *Viola odorata*, or double Parma violet. Tuberose (*Polyanthes tuberosa*) and jonquil (*Narcissus jonquilla*) are two bulbous plants, and the cassia (*Acacia farnesiana*) a pretty shrub with globular golden flowers, which thrives admirably in the south of France. Out of those flowers four only are distilled and yield essential oils, viz. rose, orange, jasmine, and cassia. Rose gives the far-famed attar, which is principally made in Turkey, near Adrianople. Orange flowers produce what is called *neroli*, a name derived from Ital. *nero olio*, dark oil, on account of its becoming dark by exposure to light. Jasmine and cassia are only distilled in Northern Africa (Algeria and Tunis) and in India, European flowers not possessing a sufficiently intense fragrance. The aroma of the other flowers is extracted by means of absorption or maceration. Besides the flowers named others are sometimes submitted to these processes, such as nignonette, lilac, hawthorn, wall-flower, lily, heliotrope, sweet pea, &c., but the quantities obtained are so small that they have hitherto been mere experiments.

Flowers for perfumery purposes are principally grown in the neighbourhood of Grasse, Cannes, and Nice, three towns situated in the south of France, close to each other. The manufacture of perfumery materials forms one of the principal branches of industry in that district, giving employment to upwards of 10,000 people, including many women and children, for whom the work of culling flowers and picking off the stalks is particularly suitable. These flowers are generally grown by small farmers, who contract with the perfumers for their crop, with the exception of orange flowers, which are always sold in the market.

The principal plants from which essential oils are made, are lavender (*Larandula vera*), spike (*Larandula spica*), peppermint (*Mentha piperita*), rosemary (*Rosmarinus officinalis*), thyme (*Thymus vulgaris*), wild thyme (*Thymus serpyllum*), and marjoram (*Origanum majorana*), which grow wild in the mountains, and are distilled on the spot by means of portable stills. An essential oil is also extracted from geranium (*Pelargonium odoratissimum*), which, from its strong *rosy* flavour, is much prized by perfumers, and the bitter orange leaves yield a powerful essence named *juité-grain*, which is used in eau de Cologne. The following table gives the average quantities of flowers and plants required to make one pound of essential oil:—

	Lbs.
Roses (<i>Rosa centifolia</i>)	10,000
Orange flowers (<i>Citrus bigaradia</i>),	1,000
Orange leaves, " "	500
Geranium (<i>Pelargonium odoratissimum</i>),	500
Lavender (<i>Larandula vera</i>),	120
Spike (<i>Larandula spica</i>),	80
Thyme (<i>Thymus vulgaris</i>),	200
Wild thyme (<i>Thymus serpyllum</i>),	200
Rosemary (<i>Rosmarinus officinalis</i>),	100

Lavender and peppermint are the only two plants grown in England for perfumery purposes. The essential oil they yield is superior to that obtained from foreign flowers. The chief flower farms in England are near Mitcham and Carshalton, in Surrey, and at Hitchin, in Hertfordshire. Some idea of the enormous consumption of lavender oil may be gained from the fact that there is annually produced in

England sufficient oil to make nearly 30,000 gallons of spirit of lavender. A large quantity is used in the production of other perfumes of more pretensions names. Soaps and toilet-washes are chiefly scented with French and Italian oil, which is worth but from 8s. to 10s. a pound, while the English oil is valued at four times that price. The difference in the value is chiefly due to the fact that in the foreign distilleries the whole of the stalks, and even the leaves, are put in the still; whereas in England, particularly at Hitchin, nothing but the choicest blossoms are used.

The fourth process, that of *expression*, is confined to the fruits of the citrine family, viz. orange (*Citrus aurantium*), bitter orange (*Citrus bigaradia*), lemon (*Citrus medica*), bergamot (*Citrus bergamia*), cedrate (*Citrus cedrata*), and lime (*Citrus limetta*). The rinds of all these fruits contain an essential oil ready formed in small vesicles, and various means are adopted to extract it. On the coast of Genoa they rub the fruit against a grated funnel; in Sicily they press the rind in cloth bags; and in Calabria, where the largest quantity is manufactured, they roll the fruit between two bowls, one placed inside the other, the concave part of the lower and the convex part of the upper being armed with sharp spikes. These bowls revolve in a contrary direction, causing the small vesicles on the surface of the fruit to burst and give up the essence they contain, which is afterwards collected with a sponge. The rinds are also sometimes distilled, but the former processes, which are called in French *au zest*, give a much finer essence.

The three principal essences of this kind used are orange (called also Portugal), lemon, and bergamot, which all enter into the composition of eau de Cologne and many other perfumes. They are made in Calabria and Sicily in the months of October, November, and December, and the quantity of fruits required to make one pound of essential oil varies as follows during that time:—

	October.	November.	December.
Oranges, . .	1500	2000	2300
Lemons, . .	1500	1800	2000
Bergamots, .	1800	2000	2300

The essence produced by squeezing the rind is yellow; that made with the machine has a green tint: the more or less ripe state of the fruit also influences the colour.

The manufacture of perfumery for general use consists principally in making scented soaps, compounding perfumes, and preparing various articles used for the toilet. There are four kinds of soap generally manufactured by perfumers: hard soap by the hot process, which is made by boiling grease, and sometimes a small portion of resin, with an excess of soda-les, until they become saponified; hard soap by the cold process, which is prepared by introducing a fixed dose of concentrated soda-les into grease in a liquefied state; soft soap by the cold process, which is obtained in the same way as the last, only substituting potash for soda-les; and transparent soap, which is a combination of soap and alcohol. The cold process is principally resorted to when a delicate colour or fine odour is to be procured. By substituting a pomade for the grease you obtain the true scent of the flower.

The next important branch of the trade is the preparation of perfumes, of which large quantities are consumed both at home and abroad. The basis of all fine perfumes is obtained by treating with alcohol the pomade or oil extracted from the flowers, as it has been explained. This may be called the truly artistic part of perfumery, for with a very limited number of flowers the perfumer has to imitate all the others. This is done by studying resemblances and affinities, and blending the shades of scent as a painter does the colours on his palette. Thus, for instance, no perfume is extracted from the heliotrope; but as it has a strong vanilla flavour, by using the latter as a basis with

other ingredients to give it freshness, a very perfect imitation of that flower is obtained, and so on with the others. There is also a large quantity of toilet water manufactured chiefly with an alcoholic basis. The most widely known is the Cologne water, which was invented in the last century by an apothecary in Cologne. It can, however, be made just as well anywhere else, as all the materials for it come from the south of France. Its perfume consists principally of the flowers, leaves, and rind of the fruit of the bitter orange tree, which blend well together, and form an harmonious compound. The toilet vinegar is a sort of improvement on eau de Cologne, with the addition of balsams and vinegar. Lavender water was formerly distilled with alcohol from fresh flowers, but is now prepared by digesting the essential oil in alcohol, which produces the same result at much less cost.

PERGAMOS or PERGAMON (Latin *Pergamus* and *Pergamon*, the latter more usual), the most important town in Mysia, was situated north of the Kaikos, on a small stream called Selinos. It had a strong citadel situated on a conical hill. Pergamos had many large public buildings. The modern town, called Bergma, is still a place of some importance, and it contains many ancient remains.

Its position, a little inland, freeing it from dangers by sea, while it had free communication with the Bay of Lashes (20 miles off) by the navigable river Kaikos, rendered Pergamos a very desirable stronghold, and it is no wonder that at the division of the empire of Alexander the Great it sprang into great importance, when after the defeat of Antigonus at Ipsus in 301 B.C., the whole of Mysia fell to Lysimachos, king of Thrace. This king, whose chief possessions lay in Europe, made Pergamos his Asiatic stronghold, and strengthened and beautified it. Towards the end of his reign his viceroy Philaiteros, in whom he had placed the fullest confidence, revolted with the help of the King of Syria, and was soon able to establish his independence (280). The nephew and second successor of Philaiteros proclaimed himself king, with the title of Attalos I. (Lat. *Attalus*), after his great victory over the Gauls (239), and his descendants continued the kingly title through three subsequent reigns. [See ATTALUS.] The last king, Attalos Philométor, dying without heirs B.C. 133, bequeathed his kingdom to the Romans, and it became the province of Asia. It was not, however, at this time the original small kingdom of Attalos I., merely the south-western corner of Mysia; for in B.C. 190, on the defeat of Antiochos of Syria by the Romans, the conquerors presented their ally, Eumenés II. of Pergamos (son of Attalos I.), with all the remainder of Mysia, all Lydia, Phrygia, Pisidia, and Pamphylia, that is, practically nearly all the western half of Asia Minor—a territory of magnificent extent and natural capability.

Eumenés was equal to his great good fortune. He founded the library which rose to the greatest fame among the ancients save only that of Alexandria. Indeed, Mark Antony during his infatuation for Cleopatra presented the library to her, and it was carried over to swell the bulk of its greater Egyptian rival. To increase the permanence of the books parchment was invented, the present name of which is derived from the name of the town which it bore throughout antiquity (*charta pergamina*). Pergamos was also the home of one of the chief schools of Greek sculpture, after the supremacy in that noble art had passed from Athens. The greatest artists were Isogonos, Parnachos, Stratonikos, and Antigonos. Already in the time of Attalos I. the works of the school of Pergamos were in such repute that on his assumption of the title of king, he sent some pieces to Rome and Athens as the most valuable and acceptable present he could make. These are now in the museums at Naples, Florence, Venice, and Rome (the Vatican), traceable by the accounts of Pausanias. The

masterpiece of the school is the superb "Dying Gladiator," the chief pride of the museum of the Capitol at Rome, since it is a genuine antique, not a marble copy of a bronze, as are so many of the finest of our statues. It seems almost incredible but that the sculptor of this splendid work of art saw the barbarian chief dying on his shield beside his broken sword, as he has represented him; and if so we have here a relic from the great defeat of the Gauls by Attalos. Certainly the figure is startlingly lifelike in pose.

The city continued its prosperity under the Romans, who made it the capital of their province of Asia. It early became a seat of Christian missionary enterprise, and figures in the Apocalypse as one of the "seven churches of Asia." We learn that it had endured a persecution, and had lapsed greatly into idolatry, "where Satan's throne is" (Rev. ii. 13). Under the Byzantine emperors the capital of "Asia" was transferred to Ephesus, and Pergamos fell from its great splendour. Apollodorus the rhetorician, who taught Octavianus (afterwards the Emperor Augustus) as a youth, and the famous Galen (*Galenus*), the physician and friend of the noble Emperor Marcus Aurelius, were natives of Pergamos.

PERGOLESI, GIOVANNI BATTISTA, was born at Jesi, near Ancona, on the 3rd January, 1710. He was educated for the musical profession at the famous Naples Conservatorio, under Gaetano Greco, Feo, and Durante. His first productions in opera were coldly received, both at Naples and Rome, for his new manner was not understood. But the Prince di Stigliano procured an engagement for him at the Teatro Nuovo. There his elegant *intermezzo*, "La Serva Padrona," which afterwards made so extraordinary a sensation at Paris, was brought out in 1731. It is not too much to say that this famous piece set the pattern for comic opera till Rossini's "Barber of Seville." Though his dramatic compositions met with little success during his short life, his productions for the church were duly appreciated, and received with the applause they deserved. The exquisitely beautiful "Stabat Mater," perhaps the finest of all the many settings of that grand hymn, and the work by which Pergolesi's genius is best marked and best known, was written for a religious confraternity at Naples at the close of his life, when consumption had already set in severely, and indeed it was finished actually upon his death-bed. His master, Feo, implored him not to work when so unfit for exertion, but he had received payment, and wished to die an honourable man. Having fulfilled his engagement he almost at once expired, 16th March, 1736.

PERI (Fairy), in Oriental mythology, a sylph or nymph, born of fallen angels, whose life is one long gleam of sunshine, one radiant burst of immortality, and only clouded by the fate which exiles her eternally from Paradise. The Peri may be either male or female, and seems half angel, half-demon, though never hostile to the interests of mankind. In most Eastern tales the spirit figures as a lovely woman; and Moore introduces her attributes with great effect into his legend of "Paradise and the Peri," which forms a portion of "Lalla Rookh."

PERI, JACOPO, the first writer of opera, was born of a noble family at Florence, about 1570 or 1575. He was full of musical invention and taste, without being very highly skilled, and enthusiastically threw himself into the aims of the Count Bardi, Vincenzo Galilei (father of the astronomer), Cavaliere, Caccini, &c., who desired to do nothing less than revive the utterly lost dramatic music of the Greeks. They conceived this to be in the nature of monodie recitation, a thing then unattempted, and Galilei accomplished the first sketch in the new art. Rinuccini the poet now produced a suitable libretto on the classical myth of Daphne, and Peri set this to music in 1597. Caccini contributing one or two of the airs. It was played privately, the composer himself taking part, and reaped a

rich harvest of applause. The fame of "Dafne" spread, and when the Princess Mary of Medici was married to Henry IV. of France in 1600, and all Florence was *en fête*, Peri was commissioned to write a grand lyric drama on the new model, Rinuccini again serving as poet. This was "Euridice." It was rapturously received, and opera composers at once sprang up prolifically. Peri seems to have retired, for nothing more is known of his writing. "Euridice" was printed in Venice in 1600, but few copies remain. The British Museum has a reprint (Venice) of 1608.

PERIAN'DROS (Lat. *Periander*), tyrant of Corinth from B.C. 655 to 585. He succeeded his father in the tyranny. (A Greek tyranny was not necessarily a cruel government, but simply a monarchy by usurpation.) At first Periandros ruled with great mildness, but several attempts having been made to shake off his power he became alarmed, and applied to the powerful tyrant of Miletos for advice. The latter declined to answer, but as the messenger of Periandros stood by he kept measuring the ripe ears of corn and cutting off the tallest. The hint was not lost on Periandros, and one by one all the best leaders of the liberal party perished. The city thus thoroughly cowed he returned to nearly his former mildness. He was a great patron of literature and the arts, and a good administrator. Corinth was never more powerful than under his sway.

PER' IANTH is the name applied to the floral envelope in those flowers in which the calyx and corolla cannot be easily distinguished, as in the hyacinth and other monocotyledons.

• **PERICARDI'TIS**. See HEART, DISEASES OF.

PERICARDIUM is the name given to the serous membrane, forming a close sac, which invests the heart. It has two layers, the parietal and the visceral, and its cavity contains just enough fluid to lubricate the surfaces of these layers and allow them to move freely over one another as the heart and lungs move in the action of the circulation and of respiration. More or less fluid than this gives rise to very serious complications, or rather is to be taken as a symptom and result of such.

PER'ICARP is strictly the shell of a seed vessel, varying very much in texture, as between the grape, where it is fleshy; the bean, where it is hard and dry; and the peach, where it is succulent externally and stony in the inside. In the last and other drupes it divides into the sarcocarp or fleshy portion, and the putamen or stone.

PERICLES. See PERIKLES.

PERICRANIUM is the tough fibrous membrane which covers the bones of the skull, and bears the same relation to them which the periosteum does to the bones of the rest of the skeleton. See BONE.

PER'IDOTE. See OLIVINE.

PER'IGEE, the point of the moon's orbit in which she is nearest to the earth; also used for the points at which any other heavenly bodies (as the sun, &c.) are respectively nearest to the earth.

PERIGUEUX, a town of France, the former capital of Perigord, and the capital of the department Dordogne, is pleasantly situated on the right bank of the Isle, which is crossed by three bridges, 310 miles S.S.W. of Paris by rail. The population in 1882 was 25,569. The old town is composed of narrow tortuous streets, but the modern parts are in a better style. The Cathedral of St. Front is one of the most remarkable buildings of Christian times. It is built in the form of a Greek cross, with five stone encolpas rising to a height of 108 feet above the pavement, and it corresponds nearly in plan and dimensions with St. Mark's at Venice, with which it is almost contemporary in age, only destitute of its internal decorations. The other chief buildings are the communal college, the library, and the natural history museum. Statues have been erected to Montaigne and to Fénelon, natives of the town. The chief manufactures are bombazine, hosiery, hats

gloves, paper, refined wax, and the celebrated pâtés de Périgueux, made of partridges and truffles; and there is some trade in iron and liquors. There are many remains of the ancient *Essana*, including those of a more extensive amphitheatre than that of Nîmes. The town continued long in the possession of the English, and was a stronghold of the Calvinists during the religious wars.

PERIGYNOUS is the name applied to the adhesion of the stamens to the tube of the calyx or corolla.

PERIHE' LION, the point of the earth's orbit in which it is nearest to the sun.

PERIKLES was the son of Nanthippos, who defeated the Persians at Mukalé, and of Agaristê, niece of the famous Kleisthenês. He was thus the representative of a noble family, and improved the advantages of birth and liberal fortune by those of education. He was a pupil of Zenô the Elætic, and of Anaxagoras. In his youth, old men traced a likeness to Peisistratos, which, joined to the obvious advantages with which he would have entered public life, excited distrust, and seems to have retarded his appearance on the stage of politics. However, about the year 469 B.C., two years after the ostracism of Themistoklês, and about the time when Aristeidês died, Periklês appeared in a public capacity, and before long became head of the popular party opposed to that of Kimôn, the son of Miltiades, who headed the nobles. About the time when Kimôn was prosecuted and fined (B.C. 461), Periklês began his first attack on the aristocracy through the Argiopes, which he succeeded in depriving of its judicial power, except in several inconsiderable cases. He now gained distinction as a general against the Akarnanians, in 454, in the Sacred War of 448, and in the reconquest of Eubœa, almost entirely due to his own skill, in 445, and of Samos in 440. After the death of Kimôn, Thucydides (Thonkudidês) took his place, but in 411 Thucydides was ostracized, and Periklês became the first man in Athens. His all-powerful influence was, however, never used for his own self-aggrandizement, nor in any other than the noblest and purest fashion. He appears to have contributed to raise Athens from the situation of chief among allies, to that of mistress over tributary states. His finishing blow to the independence of the allies was the conquest of Samos and Byzantium.

From this time to the beginning of the Peloponnesian War Periklês was engaged in peaceful pursuits. He covered the Akropolis with magnificent buildings, in which the beauties of architecture and sculpture were combined. The drama had then attained perfection in the hands of Sophokles; and by enabling the poor to attend theatrical representations, Periklês nurtured their taste and increased his own popularity. Another innovation, of which he is supposed to have been the author, was that of paying the dikasts or jurymen in the courts. At first the pay was only moderate, but it operated as a premium on attendance at the courts; the causes became a mode of excitement for a people whose intellectual activity made them particularly eager for anything of the kind, and thence resulted that litigious spirit which is so well ridiculed in the "Wasps" of Aristophanes.

Periklês being descended by his mother's side from the family of Kleisthenês, was implicated, according to the religious notions of those times, in the guilt of the murder of Kulôn and his fellow-conspirators, which was committed at the very altars in the Akropolis. The Lacedæmonians, before the actual commencement of the Peloponnesian War, urged on the Athenians the necessity of banishing the members of the family who had committed this offence against religion, as it was an indirect way of attacking Periklês and driving him into exile. The Athenians retorted by urging the Lacedæmonians to cleanse themselves from the guilt incurred by the death of Pausanias.

Periklês lived to direct the Peloponnesian War for two

years. His policy was to induce the Athenians to consider Attica merely as a post to be held or resigned as occasion required. In the speech which he made before war was declared, as it is recorded by Thucydides, he impressed the Athenians with these opinions, representing the superiority of their navy and the importance of avoiding conflicts in the field, which, if successful, could only bring temporary advantage—if the contrary, would be irretrievable.

At the end of the first campaign, Periklês delivered an oration upon those who had fallen in the war. This speech, the full transfusion of which into a modern language is an impossibility, exhibits a more complete view of the intellectual power and moral character of Periklês than all that the historian and biographer have said of him. The plague of Athens followed, and while it damped the activity of the Athenians, it increased their impatience of war. In spite of another harangue, in which he represented how absurd it would be to allow such an event as a pestilence to interfere with well-laid plans, he was brought to trial and fined, but his influence returned when the panic was



Bust of Periklês (in the Vatican).

over. In the third year of the war, having lost his two legitimate sons, his sister, and many of his best friends by the plague, he fell ill of it himself, and after a lingering sickness died.

The connection of Periklês with Aspasia is a part of his private life which is not quite clear. Aspasia was a foreigner who came to Athens, and Periklês lived with her after divorcing his wife. He appears to have been much attached to her, and probably, as she was a woman of talent and of great personal charms, she had some influence over him. His son by her was one of the Athenian generals at the naval battle of Arginusai, and was put to death, like all the rest, for not succouring the wounded, B.C. 406.

PERILYMPH is the name given to the fluid filling the cavities in the skull forming the "bony labyrinth" of the ear, floating in which fluid is the similarly shaped "membranous labyrinth," containing within it an exactly similar fluid called the endolymph; so that all sonorous vibrations are conducted to nerves surrounded by fluid (endolymph) within the membranous labyrinth, having been transmitted from the outer air through the fluid of the perilymph. The evenness of the medium, its constant rate of tension, its freedom from tendency to pressure, &c., make fluids the best conductors of sound for nerves; and nearly all ears throughout the animal kingdom are there-

fore found to contain perilymph, though many have neither membranous labyrinth nor, of course, endolymph.

PERIM', an island situated in lat. $12^{\circ} 40' 30''$ N., and lon. $43^{\circ} 28' E.$, in the narrowest part of the Straits of Bab-el-Mandeb; distant from the Arabian coast nearly $1\frac{1}{2}$ mile, and from the African between 9 and 10 miles; greatest length, $8\frac{1}{2}$ miles; average width, about $1\frac{1}{2}$; circumference (following the sinuosities of the coast line), probably more than 30 miles. It is under the government of Aden.

It is called by the author of the "Periplus" the island of Diodoros, and is known among the Arabs as Mayoon. The formation is purely volcanic, and consists of long, low, and gradually sloping ranges of hills, surrounding an excellent and capacious harbour, about $1\frac{1}{2}$ mile in length, half a mile in breadth, and with a varying depth of from 4 to 6 fathoms in the best anchorages. The hills have formerly been intersected by bays and indentures, which in the course of time have been filled up with coral and sand, and are now low plains, scantily covered with *salsola*, sea-lavender, wild mignonette, and other plants which delight in a soft sandy soil. These plains occupy about one-fourth of the island, and occur principally on the north side. The rocks, which are all igneous, are nowhere exposed, save where they dip perpendicularly into the sea; they are covered with a layer of volcanic mud of from 2 to 6 feet in depth, above which is another layer of loose boulders, or masses of black vesicular lava, in some places so thickly set as to resemble a rude pavement. The highest point of the island is 245 feet above the level of the sea. All endeavours to procure water have failed, and but a scanty supply is procurable from the adjacent coasts. Water tanks were constructed, which used to be chiefly supplied from Aden, and it was proposed to erect reservoirs to collect the rain; but, as at Aden, a condensing apparatus was found more suitable.

Perim has never been permanently occupied by any nation save the British. Albuquerque landed upon it in 1513 on his return from the Red Sea, and having erected a high cross on an eminence, called the island *Vera Cruz*. It was again occupied for a short time by the pirates who frequented the mouth of the Red Sea, and who amassed considerable booty by plundering the native vessels engaged in the Indian trade. They formed a project of settling here and erecting strong fortifications; but having with much labour dug through the solid rock to a depth of 15 fathoms in a fruitless search for water, they abandoned their design, and removed to Mary's Island, on the east side of Madagascar.

In 1799 it was taken possession of by the East India Company, and a force under Lieutenant-colonel Murray was sent from Bombay to garrison it, with the view of preventing the French troops, then engaged in the occupation of Egypt, from proceeding to India to effect a junction with Tippoo Sahib; but it was deemed untenable as a military position, and the straits were too broad to be commanded by any batteries on the shore: the troops were accordingly withdrawn.

In consequence of increasing steam navigation in the Red Sea, the attention of the Indian government was directed to the necessity of a lighthouse to facilitate the navigation of the straits. Perim was consequently re-occupied in the beginning of 1857. The lighthouse was completed in 1861, and quarters were also built for a detachment of native infantry, fifty strong, who now garrison the island under the command of a European officer. The detachment is relieved every two months when practicable.

PERIMETER, in geometry, signifies the circuit or bounding lines of a plane figure; the term is usually applied to rectilinear figures only, but without any particular reason for the restriction.

VOL. X.

PERIOD (Gr. *peri*, around, *hodos*, a path), in astronomy, is the term used to express the periodic time of a planet or a comet—that is, the time of its revolution round the sun, or the time of the revolution of a satellite round its primary.

The *synodic period* of a planet is the time in which it returns to a given position with regard to the sun and the earth, and manifestly differs very greatly from the period proper, as not only the motion of the planet but that of the earth has to be taken into account. The synodic period is, however, by far the easier to observe, and in fact the periodic time is deduced from it.

Thus from the synodic period of Jupiter, 398.867 solar days, found by actual observation of the time taken by the earth and Jupiter to return to a given position with regard to the sun, and the observed rate at which the earth gains on Jupiter in her course, it is a simple calculation (the earth's period being known to be 365.256 days) to find Jupiter's periodic time—4332.584 days.

The following are the synodic periods, and the periodic times of the principal planets:—

	Synodic Period. Mean Solar Days.	Periodic Time.
Mercury,	115.887 ...	87.9692
Venus,	583.920 ...	224.7007
The Earth,	— ...	365.2563
Mars,	779.936 ...	686.9794
Jupiter,	398.867 ...	4332.5848
Saturn,	378.090 ...	10759.2197
Uranus,	369.656 ...	30686.8205
Neptune,	367.488 ...	60126.7220

PERIODIC ACID. See IODINE.

PERIODS OF REVOLUTION, a term used in chronology for definite portions of time, beginning from any given epoch, which, being repeated again and again, will serve to divide all time subsequent to the epoch (or precedent, if the repetitions be also carried backwards from the epoch) into equal parts, for the purposes of common reckoning and historical chronology.

Periods may be divided into natural and artificial: the former immediately suggested by some recurrence of astronomical phenomena, the latter arbitrarily chosen.

When one period is contained an exact number of times in another, each recommencement of the larger one is also a recommencement of the smaller one; thus the day being exactly twenty-four hours, if any one day begin at the beginning of an hour, all days will do the same. But if the smaller period be not a measure of the larger, a longer period may be imagined, which may be called a *cycle*, consisting of the interval between the two nearest moments at which the smaller and larger periods begin together. Thus a week of seven days and a month of thirty days give a cycle of seven months or thirty weeks, these two periods being equal.

The periods in which all others are expressed is the day, which is not, as many suppose, the simple time of the revolution of the earth, but the average time between noon and noon. To distinguish it from other days it is called the *mean solar day*.

The year, or the time between two vernal equinoxes, is not a uniform period, nor does the average of one long period give precisely the same as that of another. For chronological purposes, however, it is useless to take account of this variation, and 365.2563 days, the year of astronomers in our day, may be considered as more than sufficiently exact for any time. In fact the year is made to consist, in the long run, of 365.2425 days in the Gregorian calendar.

An era means either the commencement of an indefinite reckoning or of a succession of periods. In the following list the figures following the years refer to months and

days: thus A.D. 729·6·13 would stand for the 13th day of June, A.D. 729. We do not mean to say that the events in the following list did take place in the years, far less in the months, or on the days, which are set down; but only that those who used them as eras took them as having happened in those years, months, and days. Thus the death of Alexander, according to Clinton, took place in B.C. 323, which is most likely to be right; but if those who afterwards made an era of his death reckoned from the 12th of November, B.C. 321, that day is the era, whether the event happened then or not:—

	B.C.
Mundane era of Constantinople,	5508·3·21
Civil era of Constantinople,	5508·9·1
Mundane era of Alexander,	5502·8·29
Mundane era of Antioch,	5192·9·1
Commencement of Julian period,	4713·1·1
Common mundane era (Abp. Usher),	4004
Mundane era of the Jews,	3761
Civil Jewish era,	3761·10·1
Calijug (Hindu),	3101
Era of Abraham (Eusebius),	2015·10·1
Olympiads,	776·7·1
Building of Rome (Varro),	753·4·21
Building of Rome (Cato),	751·4·21
Era of Nabonassar (Babylonian),	747·2·26
Metonic cycle,	4327·15
Calippic period,	380
Julian Reformation,	45
Era of death of Alexander (died 323),	321·11·12
Era of the Seleukids,	312·9·1
Era of Tyre,	125·10·19
Era of Vicramaditya (Hindu),	57
Cæsarean era of Antioch,	49
Spanish Era,	38·1·1
Era of Actium,	30·1·1
	A.D.
First leap-year of the Augustan reformation,	8
Era of the Ascension,	38
Indiction of Constantinople,	312·9·1
Era of the Armenians,	552·7·9
Hegira,	622·7·16
Era of Yezdijird,	632·6·16
New Style,	1582
English adoption of New Style,	1752

Before the change of style in 1752, and from the fourteenth century to that time, the legal and ecclesiastical year began on the 25th of March, though it was very common in ordinary writing to begin it on the first of January. Hence January, February, and twenty-four days of March were in one year, according to lawyers, &c., and occasionally in another according to others. Thus the Revolution, so called, of 1688, took place in the February of that legal year, or as we should say, February, 1689. It is frequently written thus: February, 1688, or February, 1688-89. King Charles was beheaded 30th January, 1649, or 30th January, 1648-49, which we should now call 30th January, 1649.

The periods which are of most use in chronological researches are the four following:—

1. The Cycle of the Sun, or Solar Cycle, or more properly the Cycle of Sundays.
2. The Cycle of the Moon, or of nineteen years, or of the Golden number, or of the Primes, or the Metonic Cycle (with its era altered).
3. The Cycle of Indictions.
4. The Julian Period.

These periods are described in the article CYCLE. See also CHRONOLOGY.

PERIOPHTHALMUS is a remarkable genus of Acanthopterygian fishes, belonging to the family Gobiidae.

The species of this genus, which are common on the coasts of the tropical Indo-Pacific, have the remarkable habit of leaving the water during the ebb of the tide, and hopping about on the mud preying on small crustaceans and the like. The pectoral fins are very strong and peculiarly modified to play the part of fore feet; and the more or less constricted ventral fins and the tail also aid in this mode of progression, extraordinary for a fish. The eyes, too, are peculiarly modified for aerial as well as aquatic vision: when the fish is on land they can be thrust far out of their sockets, and when it returns to the water they are retracted and protected by a membranous eyelid. Several species are known, one species, *Periophthalmus Kochi*, being very abundant on the coasts washed by the Indian Ocean.

PERIOPATETUM. See BONE.

PERIPATETICS (Gr. *peripattein*, to walk about), a school of ancient philosophers founded by Aristotle, who instructed his scholars in a *peripatous*, or covered walk, of the Lyceum at Athens. His doctrines were afterwards taught by Theophrastus, Aristoxenos, Strato, Eudemos, Glukôn, and Hieronymos; but none of these, or of their successors, ever attained the wide reputation or permanent influence of their master. Their chief (and very great) value lies in their reverent study of Aristotle's treatises and their comments upon them, showing clearly the view taken of his work in antiquity. Kratippos, one of the latest Peripatetics, was heard teaching at Rome by Marcus, the son of the great orator Cicero.

PERIPATUS is a remarkable genus of arthropods, of which it forms an independent class, Peripatidea or Protracheata, the latter name denoting that its affinities are rather with the Tracheata (Arachnida, Insecta, and Myriapoda) than with the Crustacea. Peripatus presents considerable resemblance to a lepidopterous caterpillar, having a soft, moderately long, brownish-black body, supported on a number of short conical legs, which are soft like the body and very imperfectly jointed. The head is distinct and has a pair of simple eyes and two many-jointed antennae. Peripatus differs from all other arthropods in having only one pair of appendages modified to serve as jaws. The next pair of appendages form short papillae on each side of the head, and contain the apertures of the remarkable slime-glands with which this animal is furnished. The walking legs vary in number in the different species; each ends in a pair of small claws. The alimentary canal is straight and simple. Peripatus agrees with the Tracheata and differs from the Crustacea in respiring by means of tracheae. Its tracheal system is very simple, tufts of very fine air-tubes being distributed to the viscera, muscles, &c., and opening by stigmata scattered all over the surface of the body. The nervous system is also remarkable. The ventral nerve-cords proceeding from the fused cerebral ganglia above the oesophagus run down on each side of the body far apart, uniting only at the extreme end of the body; they are joined by transverse commissures in each segment, and present only rudimentary ganglionic swellings. A pair of excretory organs similar to the nephridia of chatopod worms is present in every segment. Dorsal and ventral longitudinal vessels are also present. The slime-glands emit fine viscid threads at the will of the animal, and one species is said to employ this excretion for the purpose of catching insects. The sexes are distinct, and the young are brought forth alive. Several species of this genus are known from the Cape of Good Hope, New Zealand, &c. They live in damp places under stones, decaying wood, &c., and feed on insects. Two figures of *Peripatus capensis*, one showing the internal anatomy, are shown in the Plate MYRIAPODA.

PERIPHERY, the Greek word for circumference; a term applied both to rectilinear and curvilinear figures.

PERIPLUS (Lat. *Peripulus*), a record or narration of a voyage of circumnavigation. The title is almost

wholly confined to some fragments of voyages handed down to us from the classic writers, as the *Periplus* of Hanno, which refers to a voyage along the western coast of Africa; the *Periplus* of Skulax, describing the coasts of Europe and Asia; and the *Periplus* of Arrian, which relates to the Euxine and the Persian Gulf.

PERISSODACTYLA (odd-toed) is one of the sub-orders into which the order UNGULATA or hoofed mammals is usually divided. In the *Perissodactyla* the toes are reduced to three or one, or where a fourth is present it is small and does not reach the ground. In addition the stomach is simple, and a large sacculated cæcum is present. This suborder includes the following recent families, *Rhinocerotidae* (*RHINOCEROS*), *Tapiridae* (*TAPIR*), and *Equidae* (*HORSE*, &c.) As was pointed out in the article MAMMALIA, the classification of the Ungulata into *Perissodactyla* (odd-toed) and *Artiodactyla* (even-toed), though useful for recent forms, cannot be applied to extinct forms, for in the Tertiary formations several grades of degradation from the typical five-toed condition are found in the case of the direct ancestors of some of the existing *Perissodactyla*.

PERISTYLE (Gr. *peri*, around; *stulos*, a column), the court or interior area of a Roman house, surrounded with columns on three sides, usually filled by an elegant flower garden answering to our modern conservatory, and generally having a fountain in the centre. It was the open-air apartment of the family in contradistinction to the atrium, which was the general reception room, and in great houses was almost open to the public, being entered at once from the street by the vestibule. In Greek houses the peristyle was the equivalent of the Roman atrium, and was entered by the vestibule. If there was a private garden it was at the back of the house.

PERITONEUM, the membrane by which the walls of the abdominal cavity are lined, and all the abdominal organs covered. The name is also sometimes applied to the cavity itself. The arrangement of the peritoneum is similar to that of other serous membranes. It is the peritoneum which gives to all the organs within the abdomen their peculiar shining surfaces, and which, by its duplicatures, forms the mesentery, omentum, and other folds, by which these organs are attached to each other and to the wall of the abdomen, and through which their vessels pass.

PERITONITIS, an inflammation of the peritoneum. It may exist either as an acute or as a chronic disease. The chief symptoms of the acute form are pain, swelling, and tenderness of the abdomen, accompanied with fever and a frequent, small, and hard pulse. The pain in peritonitis is usually much more severe than that of any other inflammatory disease of the intestines or other abdominal organs. It is acute and cutting, and sometimes occurs in paroxysms; it is generally diffused, but occasionally it is almost confined to a single part of the abdomen; but its most distinguishing character is that it is greatly increased by pressure, so that in a severe case the patient cannot support so much as the weight of the bed-clothes, but lies on his back with his knees drawn up, and breathes quickly and lightly, moving the diaphragm as little as possible, so as to avoid the pain which its pressure would excite in the inflamed parts. The bowels in cases of peritonitis are usually, but by no means constantly, constipated; commonly also there are present nausea, vomiting, and hiccup, and almost always excessive thirst and prostration of strength. If not checked in its course acute peritonitis usually terminates fatally from five to ten days—the patient becoming more and more depressed, and all the symptoms regularly increasing till within a short time of death, when the pain commonly ceases, and a deceptive improvement in many of the other signs of the disease takes place.

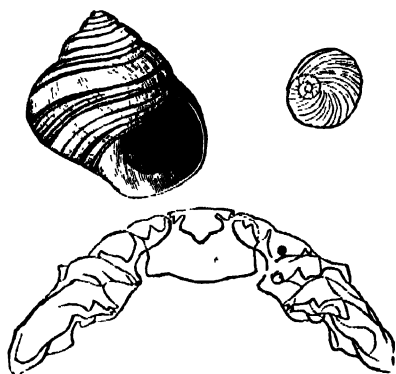
The usual morbid effects of peritonitis are the effusion of serum with lymph or pus into the abdomen, and adhesions of the opposite surfaces of the several organs within it.

The causes of peritonitis are—exposure to cold and injuries of the peritoneum, as by tumours developed within the abdomen; by the obstructions which occur in strangulated hernia and intussusception, of which it is a constant consequence; by the spreading of disease from the adjacent viscera; by heavy blows and falls on the abdomen; by penetrating wounds inflicted in operations for hernia or in other circumstances; by the passage of foreign bodies into the cavity of the abdomen; and especially by the ulcerative perforation or accidental rupture of any of the organs contained within it, and the escape of their contents—circumstances which are productive of the most certainly and rapidly fatal form of the disease.

From the foregoing it will be evident that no uniform plan of treatment can be applicable to all cases of peritonitis, and much judgment and consideration are always needed in the management of this serious disease. The drug which has the most power over the complaint is opium, and experience shows that it is remarkably tolerated in acute peritonitis. It is usually administered in the form of pill, the doses being repeated every two or four hours; but where this method is inapplicable the tincture of opium may be given in the form of enema, or morphia may be administered by subcutaneous injection. In cases where the pain is very intense the injection of morphia may be employed in addition to the internal administration of opium. Local treatment consists in the abstraction of blood by venesection or by the application of from ten to thirty leeches to the abdomen—a measure often useful during the early stages of the disease—and in the use of hot or cold applications. Hot applications are usually employed in the form of light poultices or fomentations, to which anodynes may be added, or turpentine stupes, or sinapisms. Cold applications, in the form of flannels dipped in iced water, bladders containing a moderate weight of pounded ice, or cold compresses frequently changed, are recommended by many authorities, who claim that such treatment subdues the inflammation, allays nervous irritability, and relieves the intense pain which always attends this disease. Cold, however, to be of value, must be employed during the early stages of peritonitis, and for the later periods hot applications are decidedly to be preferred. In the opening stages of the disease as little as possible should be given in the way of food, but if the patient can manage to suck small pieces of ice, they will serve to allay the thirst and mitigate the tendency towards vomiting. A little iced milk or beef tea may also be taken if they can be retained, but in the majority of cases the stomach rejects everything. In cases where recovery ensues much care is required during convalescence as regards diet and general management. In the treatment of chronic peritonitis, rest, careful attention to the state of the bowels, and mild counter-irritation are required. The diet must be light and nutritious, and the strength must be supported by the administration of cod-liver oil, quinine, preparations of iron and other tonics, and nutrients.

PERIWINKLE (*Littorina*) is a genus of molluscs belonging to the order GASTEROPODA, and family Littorinidae. The shell is thick, turbate, and with few whorls; the spire is short, and the aperture nearly circular, closed by a horny operculum; the foot is moderate, the head muzzle-shaped, and the tentacles provided with eyes at their outer bases. The Common Periwinkle (*Littorina littorea*) is very abundant on British coasts, living in the lowest zone of seaweed, between low and high water marks. The periwinkle is brought to market in immense quantities, and forms an important article of food among the poorer classes, being boiled in the shell and picked out with a pin. Periwinkles are also used by oyster-culturists to keep the beds free from weeds. Another species, *Littorina rudis*, is found in abundance on British coasts, inhabiting a higher zone of seaweed; this species is viviparous, in-

stead of oviparous like the common species, and is not eaten, in consequence of the presence of young already inclosed in a shell within the mother's mantle. Many other species are found from the sea-coasts of all parts of the world. It is interesting to notice that in caves in France and Italy, along with mammoth and reindeer remains,



Littorina littorea—shell, operculum, and teeth of animal.

there have been found necklaces and bracelets made of shells of the common periwinkle for the adornment of pre-historic men.

PERIWINKLE (*Vinca*) is the only British genus of plants belonging to the order *ASCYNACEÆ*. The genus is distinguished by its opposite entire leaves, five-parted calyx, salver-shaped corolla, bearded at the throat, with the limb divided into five broad oblique segments; the fruit consists of two oblong or elongated one-celled follicles, containing many naked seeds. The Common or Lesser Periwinkle (*Vinca minor*) is common in woods and thickets in many parts of England, but is considered not to be truly indigenous, but to have been introduced at an early period; it is wild in many parts of Europe. It is a perennial with long trailing shoots, which take root at the nodes, and erect flowering stems, which bear solitary axillary pale blue flowers. The Greater Periwinkle (*Vinca major*) is distinguished by its larger flowers and broader leaves, bordered by minute hairs. It is more uncommon than the former species, occurring in the south of Europe in woods and shady banks, and in many parts of England, where it is undoubtedly an introduced species. Both species are much cultivated in gardens, and several varieties have been produced. The Herbaceous Periwinkle (*Vinca herbacea*), a native of Hungary, flowers late, and dies down every winter. The Madagascar Periwinkle (*Vinca rosea*), a native of the West Indies, is a favourite greenhouse plant, and produces large showy flowers.

PERJURY (from the Latin *perjurium*), by the common law of England, is the offence of falsely swearing to facts in a judicial proceeding. To constitute this offence the party must have been lawfully sworn to speak the truth by some court, judge, or officer having competent authority to administer an oath; and, under the oath so administered, he must wilfully assert a falsehood in a judicial proceeding respecting some fact which is material to the subject of inquiry in that proceeding. In a legal sense, therefore, the term has a much narrower import than it has in its popular acceptance. A person may commit perjury by swearing that he believes a fact to be true which he *knows* to be false. It is immaterial whether the false statement has received credit or not, or whether any injury has been sustained by an individual in consequence of it. The offence

of perjury is a misdemeanour. Perjury must be proved by more than the mere contradictory oath of the prosecutor: he must be corroborated by some independent witness.

The punishments of perjury by the common law were—discretionary fine and imprisonment; the pillory, which was abolished in 1837; and a perpetual incapacity to give evidence in courts of justice. By the combined operation of George II. c. 25 and later statutes, the punishment for perjury appears to be penal servitude for any term, or imprisonment with or without hard labour for a term not exceeding seven years (Stephen, "Digest," art. 137). The penalties of perjury have been extended to extra-judicial matters—such as false declarations for the purpose of procuring marriage, and false affidavits under the Bills of Sale Act. *Subornation of perjury* is procuring another person to commit perjury. In Scotland the law of perjury is much the same as in England. By the Act of 1855, c. 47, subornation of perjury is directed to be punished with the pains of perjury. But as regards both it and perjury the disability to give evidence which followed on conviction was taken away by 15 Vict. c. 27, s. 1.

PERLITE. See **PEARLSTONE**.

PERM, the capital of the government of the same name, in Russia, is a modern town, built in obedience to a ukase of Catharine II., issued in 1780. It is situated at the conflux of the Iagouschika and the Kama, 715 miles W.S.W. of Moscow. The streets are broad and regular, the houses almost all of wood, and the town is surrounded by a boulevard planted with trees. It is the see of an archbishop, and has several churches and hospitals. There are some iron forges, and a steel foundry was established by the government in 1865. The inhabitants, who number about 23,000 altogether, trade chiefly in metallic produce, tea, and other Chinese imports, by way of Kiakhta.

PERMANGANATE, the name by which potassium permanganate is usually known. See **MANGANESK**.

PERMIAN SYSTEM, in geology, a series of red sandstones, conglomerates, variegated argillaceous shales ("marls"), and magnesian limestones, occurring immediately above the coal measures—though resting unconformably—and constituting the uppermost division of the **PALÆOZOIC** strata. These beds were originally so named by Sir Roderick Murchison from their typical development in the district of Perm, in Russia, and form the lower portion of the New Red Sandstone of older geologists; they have also been termed *Dyas*, on account of their subdivision into two series, and *Poikilitic*, in allusion to their variegated character, but neither of these latter names is commonly employed.

In England and Germany, the Permian rocks are divisible into an upper group, which is chiefly calcareous, and a lower group that consists almost entirely of red sandstones, marls, and conglomerates. In England, the magnesian limestone and marl slate form the upper division, and their German equivalents are the *Zechstein* and *Kupferschiefer* respectively; the lower series in Germany is known as the *Rothe-totde-liegende*—a miner's term alluding to the non-metal-bearing character of these red beds, as compared with the cupriferous layer above. The Russian Permian strata, however, exhibit no such lithological differences between the upper and lower series.

With regard to the origin of the magnesian limestone (or **DOLOMITE**), which forms so conspicuous a feature of the Permian strata in Durham and Northumberland, two theories have been propounded. Some geologists believe that the rock was originally a normal limestone, and that percolating water containing magnesian salts in solution has since altered its character; but the most probable supposition is, that it is a deposit of chemical origin, and was formed when the confined waters were overcharged with the calcareous and magnesian carbonates, which were thus thrown down together. The latter hypothesis is somewhat

supported by the fact that occasional beds of gypsum are interstratified with the limestone, and the structure of certain layers of the rock itself can only be explained by supposing them to have had a chemical origin.

The general appearance of the rocks of this age, and the fact that very few fossils are met with—and these only of stunted growth—leads to the conclusion that the deposits were formed in inland salt lakes somewhat resembling the present Caspian Sea. In the English area there appear to have been two great lake basins, the one to the east and the other to the west of the Pennine chain; and Dr. Archibald Geikie gives the following interesting table of the beds of each of these two regions contrasted:—

	W. Basin. Thickness in feet.	E. Basin. Thickness in feet.
UPPER PERMIAN.		
Red Sandstone, clay, and } gypsum, }	600	50 to 100
Magnesian limestone and marl } slate, }	10 to 30 ...	600
LOWER PERMIAN.		
Red and variegated sandstone } and marls, with breccias, and } calcareous conglomerates, . }	3000 ...	100 to 250

It would therefore appear that the eastern lake was much more free from sediment than that to the west.

The Lower Permian breccias of the Clent Hills, in Staffordshire, and of Cumberland, have led Sir Andrew Ramsay to suggest that a glacial episode occurred in Britain at that remote period; if, however, these accumulations are really old moraines, they do not necessarily imply any extensive glaciation to be compared with that of the Pleistocene Ice Age. They may represent local glaciers, such as occur at present in the higher parts of Switzerland. The fossils of the Upper Permian include Polyzoa (*Fenestella*), brachiopods (*Productus horridus*—the last species of the genus, *Spirifer* and *Terebratula*), true bivalves (*Schizodus schlotheimi*, &c.), and fishes (*Palæoniscus* and *Aerolepis*); and the Kupferschiefer of Germany and the English marl slate yield the first traces of undoubted reptiles (*Protosaurus speyeri* and *Protosaurus huxleyi*).

As regards economic products, much of the magnesian limestone makes a durable building stone. It is employed in York Minster and the Houses of Parliament. The PERMIAN SANDSTONE, with one or two other local beds, is similarly quarried for architectural purposes. The magnesian limestone is also employed in iron-smelting works; copper is largely obtained from the Kupferschiefer, and occasional veins of galena and blende traverse the Upper Permian.

PERMUTATION OF CONSONANTS, a philological term. See GRIMM'S LAW.

PERMUTATIONS of any number of qualities are the different arrangements which can be made of them *taking all together* each time. Thus a peal of four bells may be rung in the order 1 2 3 4, or 1 3 2 4, or 1 4 2 3, &c. In fact trial shows that it may be rung $1 \times 2 \times 3 \times 4$ ways, that is twenty-four ways. So eight bells give 40320 permutations; and so for other numbers; n things giving $1 \times 2 \times 3 \times \dots \times n$ permutations.

If, however, some of the objects are alike, as say the word *banana*, with three *a*'s, two *n*'s, and one *b*, it is clear that many permutations will be lost. In fact trial shows that only 60 instead of 720 permutations are available. The formula is here

$$\frac{1.2.3 \dots n}{1.2.3 \dots p \times 1.2.3 \dots q, \&c.,}$$

where n is the total number of things (i.e. the total permutations), and p and q the numbers of separate classes.

The example given (on the word *banana*) would therefore yield

$$\frac{1 \times 2 \times 3 \times 4 \times 5 \times 6}{1 \times 2 \times 3 \times 1 \times 2 \times 1} = \frac{720}{12} = 60.$$

When the things are not compelled to be all taken together, but may be taken two together, three together, &c., the changes are called **VARIATIONS**.

PERNAMBUCO, a seaport in Brazil, on the Atlantic, situated at the mouth of the Capiberibe and Ibiheribe. It consists of two towns, Recife and Olinda, nearly 3 miles distant from one another. The Cidade do Recife consists of three different parts, called Bairro do Recife, Bairro do São Antonio, and Bairro do Boa Vista. The Bairro do Recife is built on the south-eastern extremity of a low and sandy peninsula formed by the mouths of the two rivers. In consequence of their low situation neither of the towns can be effectually drained. They are, however, well paved, and supplied with good water, and São Antonio has broad streets and good houses. A railway, constructed and chiefly worked by Englishmen, extends from Recife to a distance of about 80 miles into the interior. There are horse tramways through the principal streets, and others, worked by steam, to about 10 miles into the suburbs.

The port of Pernambuco is defended by four forts, and the harbour—which is protected by a natural breakwater, formed by an extensive reef of soft calcareous and silicious sandstone—is of easy access, commodious, and perfectly safe in all weathers. Owing to the bar, no vessel drawing more than 14½ feet can enter at neap tides, or more than 18½ feet at spring tides; but there is good anchorage for any draught about 2 miles from and in front of the harbour. The exports consist chiefly of sugar, hides, cotton, and dye-woods. The most important imports are linen and cotton manufactures from the United Kingdom; indeed, more than half the entire trade of the port is with this country. The customs duties are very high, amounting altogether to nearly 50 per cent. of the aggregate value of the goods imported.

Large sums of money have been expended in attempts to increase the salubrity of the port, but epidemics of small-pox, yellow fever, and cholera are still very frequent. The shortest route to England from Pernambuco is 4056 sea miles. The population of the city and port is about 120,000.

PÉROUSE, JEAN FRANÇOIS GALAUP DE LA, was born in 1741 at Alby, in the department of Tarn, in France. He entered early into the French navy, and was appointed midshipman in 1756. He distinguished himself in several naval actions. After the re-establishment of peace (1783), the French government wishing to rival the English in making discoveries in the Pacific, La Pérouse was appointed commander of a squadron consisting of two frigates, the *Boussole* and the *Astrolabe*. He sailed from Brest, August, 1785. After doubling Cape Horn he proceeded along the western coast of North America to Monterey, and thence to Canton, and the eastern coast of Asia to Avatsha in Kamchatka. From Avatsha he sent one of his officers with an account of his voyage to Paris by land, while he himself sailed to the Navigator Islands, where the captain and eleven of the crew of the *Astrolabe* were killed by the natives. Having reached Botany Bay, where Governor Philip had just arrived to found a colony, he sent home a continuation of the account of his voyage. After leaving Botany Bay he was for a long time never heard of; but it was finally ascertained that his vessels had been wrecked, in 1788, at Vanikoro, in the New Hebrides.

PERPENDICULAR (Lat. *perpendicularum*, a plumb-line), the name given to a line or plane which meets another line or plane without inclining to one side or the other, and which therefore makes right angles with it.

PERPENDICULAR STYLE, in architecture, a term employed to distinguish Later Gothic. See the article **GOTHIC ARCHITECTURE**; also the article (and its illustrative Plates) **ENGLISH CATHEDRAL ARCHITECTURE**.

PERPETUAL CURATE was the name formerly given to the minister of a church belonging to a lay proprietor. The latter appoints a clergyman to discharge the spiritual functions for which he is not qualified, and the person so appointed enters upon his cure without induction or institution, and requires only the bishop's license. District churches subject to the parish church were also called perpetual cures. The term is now obsolete, as all persons to whom it was formerly applied are called vicars, by virtue of the 31 & 32 Vict. c. 117, passed in 1868.

PERPETUAL MOTION, a vain search after which periodically afflicts the minds of men, resembles the quest of the philosophers' stone, or the elixir of life, or the quadrature of the circle: all of them things which may be possible, but which are so closely akin to impossibility in their improbability that sane intellects unhesitatingly renounce them. Since every machine must wear, and even apart from wear must encounter the friction of its bearings and the resistance of the air or of an attenuated medium, energy must be lost by it; or to be more accurate, energy must be transmuted into heat or other forces. Unless, therefore, the machine be supplied with energy from without it cannot work for very long, however cleverly it may be constructed; but this by the conditions of the problem is forbidden, and the problem is therefore altered to the question of how to produce motion without friction—an impossibility in our present state of knowledge of physics. The nearest approach to perpetual motion as yet gained has been by very accurately constructed machines depending upon the tides for their impulse. The earth and the planets are of course instances in nature of the possibility of the idea.

If the strict definition of the problem be taken, as often stated in the scientific works, to be "a machine which will maintain its own motion unaided, and at the same time do work outside itself," it is a manifest absurdity on the face of it, by the unalterable laws of the conservation of energy; but this is not the popular meaning of the term. A frictionless machine turned by the tide would be held to fulfil the problem.

PERPIGNAN, capital of the French department of Pyrénées-Orientales, and a fortress of the first class, is situated at the junction of the Basse with the Tet, 5 miles W. from the Mediterranean, 525 miles S. from Paris, and had 31,735 inhabitants in 1882. Formerly the capital of Roussillon, it passed with the rest of that province into the hands of the kings of Aragon, and became in 1349 the seat of a university founded by King Pedro. In 1474 it was captured, after a most vigorous resistance, by Louis XI. of France. Having been restored to Spain, it was again taken in 1612 by Louis XIII., and was included in the cession of Roussillon to the French. A strong citadel commands the sea side. There are barracks for 5000 men, built by Louis XIV., and occupying one side of the parade. The most remarkable buildings are—the Cathedral of St. Jean, the churches of St. Jean-le-Vieux and La Real, the town-house, the mint, the former churches of the Cordeliers, Carmelites, and Dominicans, the Carmelite convent, now the arsenal, &c. The town gives title to a bishop. It has a tribunal of commerce, a custom-house, a clerical school, primary normal school, school of design, Catholic college, two hospitals, a theatre, a botanic garden, and a public library of 18,000 volumes, kept in a part of the old university buildings. The manufactures are broad-cloth and woollen stuffs, paper, hats, playing cards, leather, brandy, soap, and corks. The chief articles of commerce are red and liquer wines, brandy, oil, silk, wool, iron, and corks.

PERRAULT, CHARLES, the acknowledged prince of fairy tale writers, was born at Paris in 1628, the son of

a lawyer. His brother Claude grew famous as an architect, though he was brought up as a physician: and the really fine eastern façade of the Louvre (1666–70) and the Observatory (1667–72) are due to him. Charles in like manner began life as an advocate, following his father, but quitted the bar for literature when his father bought him a public office (a sinecure or practically so) in 1662. Colbert found out his abilities and used him as secretary to his literary assemblies. Charles Perrault's influence with Colbert gained Claude Perrault the opportunity to show his architectural talents. In 1671 Charles was elected a member of the Academy. Here his chief work was one which made much noise at the time, "Parallel between the Ancients and the Moderns," Perrault taking the side of the latter (1688). Boileau, the French equivalent for our Dr. Johnson on his worst side, without the good doctor's many noble traits and accurate scholarship, bullied and hectored Charles Perrault in defence of the ancients; but after eight years the combatants shook hands, and the contest then went on in England, the combatants being Wotton, Boyle (or rather Atterbury in his name), the great scholar Bentley, the learned Sir William Temple, and the unrivalled satirist Swift. The main point of attack was the spurious Epistles of PHALARIS, and the great gain to literature was the famous mock-heroic poem, the "Battle of the Books," of Swift, not published till 1704. Wotton's "Reflections on Ancient and Modern Learning" came out in 1694. Charles Perrault wrote also the somewhat heavy "Eloges des Hommes illustres au 17me Siècle" (1696–1701).

But his unconsidered trifles, the fairy tales, probably a mere amusement of idle hours, have earned him immortality, while these laborious tomes are now no longer read. When we say that the "Sleeping Beauty in the Wood" (1696), "Red Riding-Hood;" "Blue Beard;" "Puss in Boots;" "Cinderella," and "Hop o' my Thumb" (1697), as well as other stories, derived their origin from Perrault in the form in which we know them, it is sufficient to have pointed him out as a benefactor to his race. He did not, it is true, invent these charming stories; most of them are very old, and were traditional in races whose very existence is now a memory. What was really his own was the exquisitely simple clear style in which the tales are told, a pattern devoutly followed ever since by all who would seek to interest children or deal with the marvellous. His unaffected artlessness never degenerates into purity, and while he is vivid in description he is equally remarkable for terseness. Every stroke tells, and consequently the stories have the merit of being very short. Moreover, extraordinary as it may seem to those who know his other works, charming flashes of delicate wit irradiate these tiny jewels of the literary art. Though all of them could be easily printed on one side of an ordinary newspaper in moderately large type, Perrault's fairy stories have given their writer a right to an honoured niche in the temple of fame.

PERRY, a pleasant and agreeable drink, made from pears in exactly the same way as cider is made from apples. See **CIDER**.

PERSECUTIONS, the historical term by which certain periods of excessive severity towards the early Christians are distinguished. The idea of the Roman government was that religion was subordinate to the state, the latter being regarded as the centre of all human interest. As the Christian religion substituted for the state a universal kingdom of God, embracing and superior to all human politics, it can be easily understood that the new faith was peculiarly abhorrent to the Roman authorities, from its simplicity, its aggressive character in reference to the established creeds, and its formation of small private assemblies or congregations. These latter were especially obnoxious to the Roman rulers, who regarded them as secret societies. But the existing laws against new religions were not always enforced, and least of all by the worst of the emperors, who

were most indifferent to the welfare of their subjects. The fact seems very anomalous to Christians, that the church was most persecuted by the best of the Roman emperors; but it was only consistent in men with a high sense of duty to seek to stamp out what they must have considered a fatal and impious delusion. The case of Nero is no exception, since his cruelty was not directed against Christians for what they were, but for an accidental cause. Besides, persecution was often forced upon the government by popular clamour excited by individuals—priests, magicians, craftsmen, &c.—who would be losers by the gain of Christianity (see Acts xix. 23–41). Ten general persecutions—that is, persecutions extending over the whole Roman Empire—are usually recognized: (1) under Nero, A.D. 64–8; (2) under Domitian, 95; (3) under Trajan, 107; (4) under Hadrian, 125; (5) under Marcus Aurelius, 166–77; (6) under Septimius Severus, 199–204; (7) under Maximinus, 235–38; (8) under Decius, 250–52; (9) under Valerianus, 258–60; and (10) under Diocletian and Galerius, 303–13. In later times different bodies of Christians turned their arms against one another, according as they enjoyed power or sank into decay; and sanguinary feuds have marked the gradual progress of a religion which breathes only of love and mercy. We can here only refer to the massacre of St. Bartholomew's Day, on 24th August, 1572, and the Marian persecution, 1553–58, in which the Protestants were the sufferers; the crusade against the Albigenses in 1207–29; and the persecution of the Waldenses in the seventeenth century.

PERSEPHONE (Lat. *Proserpina*), the wife of Hades and queen of the under-world in the Greek mythology. Her name in Attica was simply *Kora* (daughter), as the great myth about her specially centres in the love of mother for daughter. Her mother, Déméter, is the mother (mētēr), and she is the daughter (korē), types of all mothers and all daughters. The father of Persephonē was Zeus himself. Hades carried off Persephonē as she was gathering flowers, and owing to her having bitten a pomegranate in the under-world, was enabled to enforce his right to her possession, at all events for part of the year, against the sorrowing mother Earth. [See DEMETER.] This story is as ancient as Hesiod, and lay at the root of the Eleusinian mysteries and of many other ceremonies and legends; but nevertheless not a trace of it is found in Homer.

PERSEPOLIS, a ruined city, mentioned by Greek writers after the time of Alexander as the capital of Persia. It was situated in a fine plain near the union of the Bundemir and the Kur, and its ruins cover a wide surface. On a terraced platform 1400 feet in length, and from 800 to 900 feet in width, are large gateways, numerous columns, and bas-reliefs, the whole supposed to be the remains of the palace of Darius, which was burnt by Alexander the Great. The walls are covered with inscriptions in arrow-headed characters, and numerous tombs are cut in the adjacent mountains.

Persepolis is probably merely the Greek equivalent for "Persian city," or strictly "city destroying." It is curious that the charcoal which is found spread among the débris on the floor of the palace has proved to be, under microscopic examination, that of the cedar, most probably showing that the beams and roof were derived from Lebanon.

PERSEUS, one of the most striking figures of the Greek mythology, was grandson of Akrisios, king of Argos. An oracle informed the king that his grandson should destroy him; therefore, as he had but one daughter, Danaë, he thought to evade his fate by preventing her marriage. The only way to be sure of this, as she was lovely and accomplished, was, he thought, to imprison her in a tower so constructed that she could receive sustenance without being seen, but could not hold communication with any one except the king, nor was there any entrance left to the tower after she had entered it. Some say the tower was of brass, some of stone. This atrocious selfishness and

want of parental feeling met with no success; for Zeus, having seen the maiden from the sky as she sat in her tower, poured himself down into her lap in a shower of gold. When Akrisios visited his daughter a long time afterwards, he learned that she had given birth to a boy. Bursting open the tower he dragged forth mother and child in a fury, cast them into a chest, and pushed it out to sea, that they might both perish, and that thus, even though he had a grandson, he might yet live safely. Father Zeus watched over his offspring, and the chest floated unharmed with its burden onwards across the sea to Seriphos, one of the islands of the Cyclades. A fisherman dragged it ashore and saved the pair. This was Diktus, brother of Poludektēs, ruler of the island. He was kind to the woman and her child, and Perseus grew up to be the acknowledged chief of all the youths of the island. Meanwhile Poludektēs had seen Danaë, and had fallen in love with her; but fearing to approach her while Perseus was by to protect her, he sought for an opportunity to rid himself of the youth. Once a discussion arose among the warriors of the island as to what feats of daring each would undertake for the honour of the king. Perseus spake as boldly as the rest. Then Poludektēs, seeing his chance, challenged him to fetch the head of Medousa (Lat. *Medusa*). Perseus, dimly suspecting evil, but rejoicing in the danger and difficulty of his task, set out. The gods Hermēs and Athēna took pity on him and led him to the Graiæ (gray ones), three aged crones, immortal, yet able to grow old, and consequently in the last stage of decrepitude. They had but one eye and one tooth between them, and these they passed to one another as occasion needed. Perseus, by a trick, seized both these indispensable possessions, nor would he return them till he had learned where the nymphs lived who kept the helmet of Hades, which rendered the wearer invisible, the winged sandals which bore their wearer through the sky, and the magic wallet. With these, he had been told by his divine protectors, he might accomplish his task. The nymphs gave him their treasures, Hermēs added his own curved sword or sickle, and Athēna a shield of polished brass serving as a mirror. Borne by his sandals he flew across to the Gorgon's home, near the springs of the river Okeanos. There the two Gorgons lay, their bodies covered with scales like serpents, with huge tusks, hands of brass, and wings of gold, serpent-women immortal. Near them lay their mortal sister Medousa, who had been very lovely, and had attracted the god Poseidōn, meeting him in the temple of Athēna; but the insulted goddess had changed her beautiful hair to a mass of writhing snakes, and given her face the horrible power of turning any one to stone who looked upon it. Perseus therefore, as instructed, approached the Gorgon walking backwards, guided by her image reflected on his shield, and was able at one blow to decapitate her, and plunging her head into his wallet, to make off by means of his winged sandals before the sisters of Medousa could understand what was happening. They heard sounds, but saw nothing. From the headless trunk of Medousa sprang Pégasos the winged horse (who at once flew up to heaven to become the servant of Zeus), and the monster Chrysaor.

Fatigued with his long flight across the sea Perseus demanded hospitality of the giant Atlas, as he stood holding the heavens and the earth asunder. It was refused, and Perseus, indignant, resolved to test the power of the Gorgon's head. He exposed it, and the huge bulk of Atlas stiffened into stone, the mountain still performing the work of the Titan in holding up the sky.

Flying further he saw a naked maiden chained to a rock in mid ocean; and coming towards her he saw plunging through the waves a huge sea-dragon, evidently bent upon devouring her. Perseus flew to the rescue, stiffened the monster into stone, "which is to be seen there to this day" as the old books said, and then taking off his helmet of

invisibility stood before the astonished maid as her deliverer. This was Andromeda, doomed to die in this manner by her father Kepheus and her mother Kassiopeia, not from cruelty but at the bidding of an oracle, in order to save their land from the ravages of the fearful sea dragon sent by Poseidon to avenge an insult. Andromeda was as lovely as Perseus was handsome, and when the sorrowing parents arrived they found the youth and maiden already agreed to marry. Nothing could be refused to so generous a deliverer, and Kepheus blessed the union. But Andromeda had previously been betrothed to her uncle Phineus; he therefore, assembling a body of soldiers, burst in upon the wedding feast, seeking to carry off his lost bride. The fight was wavering in the balance when Perseus adopted his last resource, exposed the Gorgon's head, and Phineus and all his company were turned into stones as they stood: "and the stones are there to this day." Evidently these myths all arise out of some remarkable stones like human and animal figures on the seashore and out in the waves.

Perseus now borrowed a boat of King Kepheus, and with Andromeda sailed for Seriphos. Poludektēs had already begun a violent persecution of Danaë, who with the virtuous Diktus had fled into sanctuary. Perseus avenged his mother's wrongs by again using the Gorgon's head, and turning Poludektēs and his supporters into so many stones. The whole hated island, save the belongings of Diktus, suffered a like punishment, and as the expressive legend has it, giving a last felicitous touch, "even the frogs became dumb."

Handing over to Hermēs the helmet, sandals, wallet, and sword, and to Athena the shield and the Gorgon's head (which she wore on her shield ever afterwards), Perseus, with his mother and his wife, sailed for Argos to find his grandfather. Akrisios had heard rumours of the great fame of Perseus, and feeling sure that he would seek him either as friend or foe he fled to Larissa in Thessaly. Perseus, desiring to forgive his grandfather and be friendly with him, followed there, and in some sort appeased the old man's fears. Games were set on foot to celebrate the reunion by King Teutamidas of Larissa, and the renowned hero took part in them. But as he was throwing a very heavy discus, to the admiration of the beholders, it fell after one of the casts right on to the foot of Akrisios, by an unhappy chance, and so crushed it that he died. Perseus buried him honourably, and returned to Argos. He afterwards exchanged Argos for Tiryns (Tiryns), the scene of famous excavations in these our own later days.

Perseus and Andromeda had many children during their long rule over Tiryns and Mukeiai (Mycenæ); of these Elektruōn is remarkable as the father of Alkmene, and Alkaios as the father of Amphitruōn. Amphitruōn married his cousin, and she became by him the mother of Eurystheus, and by Zeus, who deceived her, adopting the form of her husband, the mother of Hēraklēs. But even before leaving Æthiopia, the country of her parents, she had borne a boy to Perseus; and from this boy, Persēs, the kings of Persia traced their descent.

It is now usually believed that the wanderings of Perseus, the child of the golden rays of the sun, are meant to typify the wandering of the sun in the heavens, and as light shows the demons of darkness to be mere inanimate forms, so did Perseus turn men and monsters into common stones. Without pressing the theory unduly hard, there is little doubt but that the myth had some such origin. It is one of the most favourite subjects of the Greek mythology with sculptors and painters, both ancient and modern.

The whole group, Perseus, Andromeda, the monster (Lat. Cetus), Kepheus, and Kassiopeia, were imaged forth to the fancy of our progenitors in the five great well-known constellations of the northern hemisphere bearing their names.

PERSEUS (constellation). This constellation is surrounded by Andromeda, Aries, Taurus, Auriga, Camelopardalis, and Cassiopeia. Of the two principal stars α and β (the latter of which is the famous variable star called Algol), the former is situated in the breast of the figure, the latter in the head of Medusa, which Perseus carries in his left hand. [See PLATE CONSTELLATIONS, Northern Hemisphere.] The splendid cluster of stars in the "sword-handle" is perhaps the most amazing group of stars in the heavens. Even a small telescope reveals a large number of stars within the group, but in a good telescope the richness of aggregation is almost indescribable.

PERSEUS, the last king of Macedonia, reigned B.C. 178 to 168. He felt that war to the death was inevitable with the rapidly growing power of the Roman people, and began to prepare troops immediately on his accession. War broke out B.C. 171, and for three years went rather in favour of Perseus. His avarice led him to alienate his allies, notably Eumenes, king of Pergamos, and the Gauls, the latter actually being on their way to assist him, 20,000 strong. Consequently, in the fourth year of the war, he fell at Padiua (168) before the consul Lucius Æmilius Paulus. He was carried to Rome, and figured in his conqueror's triumph (167 B.C.) He was at first imprisoned, but the generous Paulus procured his establishment at Alba in honourable captivity.

PERSIA, a large country in Asia, called *Iran* by the natives, lying between 25° and 40° N. lat., and lon. 44° and 62° E., bounded on the S. by the Indian Ocean and the Persian Gulf; W. by the Shat el Arab, or united Euphrates and Tigris, and a line thence along the western base of the Pushti Kuhl, or Mountains of Luristan, continued northward through the mountains of Kurdistan to Mount Ararat and the upper course of the Aras River; N. by the river Aras to within 30 miles of its confluence with the Kur, by a line from that point to Astara, on the Caspian; by the S. shores of the Caspian thence to the Atrek River, by the Atrek, and a line drawn from its upper course to meet the Heri-rud above Sarakhs; E. by the Heri-rud and a line drawn southward from it to the Indian Ocean, at a point about 40 miles W. of the port of Gwadar in Beloochistan. Attention was drawn to the eastern frontier of Persia through the annexation of portions of S.W. Afghanistan and of Beloochistan by Persia, and in 1871 a British Commission was appointed to decide the differences that had arisen, and to lay down a boundary in this direction. The line decided upon runs from the above mentioned point on the coast of the Indian Ocean, north-eastward through Mekran, then northward through the swamp of Hamun, including the greater part of Seistan Proper within the Persian limit, to the Heri-rud below Herat. The N.E. frontier line was settled by a treaty between Russia and Persia in 1881. It extends 700 miles from N. to S. and 900 from E. to W., and contains 610,000 square miles.

Surface and Soil.—The table-land of Persia has an elevation of from 3000 to 4000 feet, but it is traversed by mountain ranges rising to 7000 or 8000 feet, which also surround it on the north, east, and west. In the Elburz chain, on the N., is the summit of Demavend, 18,600 feet high. The Persian mountains are mostly of a primitive character; granite, felspar, porphyry, and mountain limestone enter largely into their composition; they also exhibit indications of volcanic action—Demavend itself being an extinct volcano—and earthquakes are still of frequent occurrence in the north and north-west. In the east is a wide and irremediable salt desert, forming a portion of that rainless and sterile zone which extends from the Atlantic throughout the Sahara of Africa, Arabia, Central Asia, and Mongolia, to the mountains on the northern frontier of the Chinese Empire. The low land on the Persian Gulf is intensely hot, the summer being almost insup-

portable, and the soil mostly parched up and barren. The central desert extends from 40 to 350 miles in width from north to south; and in length through nine degrees of longitude. Its nature varies in different places. In some the surface is dry, and even produces a few of those plants which require a salt soil; in others the earth is covered with a crust of salt an inch thick. A considerable portion is marshy, and in certain spots sand predominates. In several parts rocks rise abruptly, though in general only to a moderate elevation. These rocks, usually short ridges, inclose small oases or fertile spots where water and herbage are found.

The west of Persia contains many exceedingly fertile tracts, but much of the country can be cultivated only by artificial irrigation. Of the entire kingdom, by far the greater portion is unproductive.

Rivers and Lakes.—Only those parts of Persia which are included in the plains of Ghilan and Mazanderan, in the table-land of Azerbaijan, and in the mountains of Kurdistan, are well watered. The rivers of Ghilan and Mazanderan have a short course, but they are usually navigable for some miles from their mouth, except where the woods on their banks form an impediment. The most considerable river in the table-land of Azerbaijan is the Sefidrud, Kizil Uzan, or White River, which enters the Caspian after a course of 350 miles. Two rivers, each running about 100 miles, fall into the Lake of Urumiyeh: the Aji, which runs some distance north of Tabriz, and the Inghatu, which falls into the lake not far from the most south-eastern angle. Three of the rivers which drain the mountains of Kurdistan run between 200 and 400 miles: the Diyalah, which joins the Tigris below Bagdad; the Keikhah, which falls into the Shat-el-Arab, a few miles below Kornaah; and the Karun or Kurau, which joins the same river at the point near its mouth where it begins to divide into numerous branches. The only other stream of any importance is the Bund-Emir, which falls into the Lake of Bakhtegan, after a rapid course of about 150 miles.

As a great part of the soil of Persia is impregnated with salt, the lakes are salt also, except in Ghilan and Mazanderan, where there are several small ones of fresh water. There are many salt lakes in the table-land, the largest being that of Urumiyeh or Shahi (called Spauta by Strabo), which is 85 miles long and 27 miles wide; its greatest depth is only 4 fathoms, and its water is so intensely salt as to be unable to support any but the lowest kinds of animal life. It contains numerous small islands. Another extensive salt lake is that of Bakhtegan.

Climate and Productions.—The temperature of Persia exhibits every variety, from the snows and severe cold of the mountain deserts to the almost torrid summer heat of the plains. The climate of the Caspian provinces is similar to that of Europe, and the grains common in that continent are plentifully raised. The Persian wheat is said to be the best in the world. Here also the mulberry flourishes, and silkworms are generally reared. Besides grain, the principal products of the country are rice, cotton, tobacco, silk, gull nuts, madder, yellow berries, gum ammoniac, assafœtida, and other drugs; wool, wine, saffron, &c. The wine of Shiraz is celebrated by the Eastern poets, and the vine still flourishes there. Dates are extensively used for food, and the melons are the finest in the world. Indeed, many of our most esteemed fruits are said to have been imported into Europe from Persia, such as the peach, almond, mulberry, &c. The nomadic tribes, especially the Kurds, not unfrequently make irruptions into the cultivated parts, and carry off the produce, and from this and other causes agriculture has much degenerated. Poppies are still largely grown for the preparation of opium, and roses for the much-prized otto of roses. In some parts the loveliest flowers—tulips, anemones, hyacinths, ranunculuses, pinks, jasmynes, and violets—flourish untended by the

wayside and in the fields. North of the Elburz Mountains the country is covered with dense forests of oak, elm, beech, and box, interspersed with fine pastures and numerous vineyards.

The domestic animals of Persia are camels, horses, asses, mules, black cattle, sheep, and goats. The Persian horses are noted for their beauty, strength, and speed, especially those of the Turkoman tribes. Asses are numerous, and some of them of superior size and strength. Mules and camels are used for the transport of goods more than any other animals, the former in the mountains and the latter in the deserts. Sheep and goats are very abundant, and with cattle they compose the principal wealth of the wandering tribes of Moguls, Turks, Uzbeks, and Kurds, who dwell in all the outlying provinces of the kingdom. The sheep are remarkable for the length of their tail, which sometimes exceeds 30 lbs. in weight. Wild animals are still numerous in the less populous districts of Persia. Among them are the lion, tiger, hyæna, jackal, wolf, wild boar, wild ass, antelope, and deer. The song-birds include the nightingale, the blackbird, and thrush. Pheasants are found on the coasts of the Caspian Sea, and pelicans and bustards on those of the Persian Gulf. Elsewhere birds are rare, from the absence of trees. There are few fish in the rivers, but valuable fisheries on the shores. Swarms of mosquitoes and gadflies infest the jungles and swamps, and hosts of locusts occasionally visit the land, destroying every green thing, and themselves supplying food to myriads of wild fowl.

Iron is abundant in many places, but it has never been worked. Lead, copper, antimony, rock salt, and bitumen are among the mineral products of the country. Salt is also obtained from the waters of lakes Urumiyeh and Bakhtegan. Forty miles west of Nishapoor are famous mines of turquoise. Coal is found in the Elburz Mountains, as well as fine varieties of marble; sulphur, naphtha, and garnets are also met with, but no attempt has ever been made to take advantage of this mineral wealth.

Inhabitants.—The population of Persia was estimated in 1881 at 7,653,600.

The Persians constitute the bulk of the population, and are merchants, agriculturists, and manufacturers. The number of the Parsis is small, and they appear to be numerous only in the oasis of Yazd. Their language differs considerably from that of the Persians; they are not Mohammedans, but adhere to the religion of Zoroaster, as it is contained in the Zend Avesta, and adore fire as the symbol of the divinity. They are distinguished by the purity of their life and their honesty in all transactions, and occupy themselves mostly with agriculture and the raising of fruits. The Armenians live in all the great towns, where they are merchants. Arabians form the bulk of the population in Daghistan, or Gurmair, where they gain their livelihood as fishermen, seamen, planters of date-trees, and merchants.

The wandering tribes are comprehended under the general term of *Moguls*, or clans, and are found in every part of Persia; but many of them have become inhabitants of towns. A considerable number, however, adhere to their original mode of life, and live all the year round in tents, in the winter keeping to the plains, and in summer seeking the pasture of the mountains. They acknowledge a limited allegiance to the shah.

The Kurds are in possession of a large tract of the mountain region of Khorassan, on the northern border of the table-land of Iran. The other wandering tribes include Turks, Laks, Arabs, Moguls, Uzbeks, &c. They dwell in tents, subsisting on the produce of their herds and on plunder, the caravans being often robbed by them; and they furnish most of the armed force of the kingdom, which is at times very large, but varies considerably. Altogether the Persians are a handsome, active, and generally

warlike people. The population of the towns and settled districts are Mohammedans of the Shiah sect, rejecting the authority of the three first caliphs; on which, and on other accounts, there is a perpetual feud between them and the Turks, Arabs, Bokharese, and other Mussulmans. Education, to the extent of reading and writing, is general in the towns, where there are some schools for gratuitous instruction. Astrology, astronomy, logic, and metaphysics are the favourite studies of the learned. The Scriptures were translated into the Persian language, and sent into the country for circulation by agents of the United Presbyterian Church of Scotland. For administrative purposes Persia is divided into twenty provinces. The capital is TEHRAN.

Manufactures and Commerce.—The manufactures of Persia are numerous and of various kinds. In making some articles the inhabitants are still distinguished, as in several kinds of silk stuffs, especially broads, and sword blades, leather, carpets, Kerman shawls, felt of camel-hair, and jewelry. No machinery being used, the cotton and silk goods introduced by the British have obtained a ready sale, owing to their cheapness.

The internal commerce of the country is very considerable and centres chiefly at Tabriz. The different regions which compose this extensive empire differ so considerably in their natural productions, that the transport alone of commodities gives occupation to a great number of merchants and others. To this must be added the produce of the manufactures, and the numerous articles which are brought into Persia from the neighbouring nations, especially from India, and are distributed all over the country. This commerce is entirely carried on by caravans, which usually comprise a very large number of persons and animals of burden, and have regularly defined routes across the empire in various directions. The imports from India to Persia consist principally of shawls, piece-goods and yarn, spices, sugar, tea, coffee, tin, iron, wood, drugs, glass-ware, and gold embroidered cloth. The exports sent in return are dried fruits, drugs, swords, daggers, cutlery, and horses.

The direct trade between Persia and England is exceedingly limited, but English cotton goods are annually imported to a large extent, mostly through Trebizond, on the Black Sea; and Persian silk arrives in England through indirect channels. The trade of the Caspian Sea is monopolized by the Russians; many of the most successful industries are in the hands of Russian merchants and capitalists.

The principal article which Persia has to offer for exportation to Europe is raw silk, which was formerly obtained in large quantities from Ghilan; but in consequence of a disease having attacked the silkworms, the yield has much decreased. The southern and eastern provinces of the country were desolated with famine in 1871-72, in consequence of an unprecedented drought in the preceding year. In many districts, especially Ghilan and Mazanderan, the decline of the silk trade has caused greater attention to be paid to other industries, such as the fisheries, cultivation of rice, &c. The growth of tobacco has also been introduced with success. The cost of transport is the greatest hindrance. In fact, the great want of Persia, next to the security of property, is improved roads and the introduction of railways. When the shah visited England in 1873 certain concessions were made to Baron Reuter, who in return was to carry out modern improvements in irrigation, railways, &c.; and before the close of 1874 the works for the first railway, from Resht to Teheran, were actually commenced; but disputes having arisen they were almost immediately abandoned. In 1876 a regular weekly postal service was established in Persia, connecting Russia with Tabriz and Teheran, and the latter with Resht. Being managed by Europeans, letters reach their destination with much regularity. There is also a system of telegraphs, ex-

tending to nearly 4000 miles, but the service is very irregular and unreliable. Arrangements were made in 1883 to place steamers on the river Karun, which enters the head of the Persian Gulf, and to construct roads from Shuster to Teheran, thus opening up a trade route from the south. A better system of administration and improved communications would render Persia a highly flourishing country.

Government, &c.—Persia is an absolute monarchy. Limitations from custom formerly existed, but were annihilated in the intestine wars which desolated the country during the last century. In Persia the word of the king is law, and the life and property of the subject are in his hands. It is only, however, as vicegerent of the Prophet that he claims implicit obedience, and it is only, therefore, in so far as it is not opposed to the accepted doctrines of the Mohammedan religion that his power can be considered truly absolute. The shah is assisted by a grand vizier, who exercises control over the military and foreign departments, and by a lord high treasurer, who superintends the revenue and home arrangements, and by five other ministers. Each province, or important district of a province, is governed by a "beglerbeg," usually a prince of the royal blood, or a nobleman of high rank, who exercises almost absolute authority—the power of life and death only being reserved—and appoints "hakims" over the subordinate districts. Each town and village has its magistrate, who is generally chosen by the people. The revenue of the sovereign is derived from a land-tax, customs duties, taxes on vineyards, horses, and other animals, and the "gifts," as they are called, presented at the new year and other times. "The governors present to the king, the subordinates to the governor, and so on through all ranks; and woe betide the wretch who neglects to give, or gives sparingly." The annual receipts amount to £1,600,000 in money, besides £250,000 in kind, consisting of barley, wheat, rice, and silk, making the total revenue equal to £1,850,000. Of the total revenue £1,520,000 come from direct taxes, and £330,000 from customs. The expenditure amounts to about £1,800,000, of which £760,000 is for the army, £360,000 for regal court; priesthood, &c., £240,000; foreign affairs, £28,000; other departments, £60,000; education, £12,000. About one-fourth of the receipts are constituted by payments in kind, mostly reserved for the use of the army and the shah's own household. The whole revenue is raised by assessments upon towns, villages, and districts, each of which has to contribute a fixed sum, the amount of which is changed from time to time by tax-assessors appointed by the government. Almost the entire burden of taxation lies upon the labouring classes, and, among these, upon the Mohammedan subjects of the shah. The amount of revenue collected from the Christian population, the Jews, and the Guebres, is reported to be very small. Any surplus revenue is paid into the shah's private treasury, in addition to the gifts alluded to above. There is no public debt. The army consists nominally of 105,000 men, but is really only about 30,000, of which 10,000 are irregular cavalry. Until recently the troops were badly armed, and every appointment, from that of the general downwards, was sold to the highest bidder; but some improvements have been introduced since 1874, by Mushirud-Dowleh, the minister who in the previous year had accompanied the shah as grand vizier throughout his European tour; and who has copied several of the best features observed in foreign armies. Some English officers have also had the organizing of a small fleet which the shah has created, and by a decree issued in 1875, it was ordered that the army should for the future be raised by conscription, instead of by irregular levies, and that a term of service of twelve years should be substituted for the old system, under which the mass of the soldiers were retained for life; but the decree has not been enforced to any extent. All the subjects of the shah are considered as

his slaves, and he is approached by them with the most degrading prostrations. The bastinado is employed as a punishment for all classes. The punishment of death is inflicted either by decapitation, stabbing, or torture. In consequence of the civil wars and the oppressions of the government, agriculture, manufactures, commerce, and learning have much retrograded.

As in the East generally, the women are guarded with great jealousy, never walking out except closely veiled. On account of their politeness, the Persians proper have been called the French of the East. In fact, among no people in the world are the forms and ceremonies connected to be proper more strictly observed on public occasions, as well as in the intercourse of private life. Etiquette has, in fact, the rank of a science. Even the time and manner of smoking and taking coffee are matters of importance, and a welcome or its opposite may be signified by the way in which these favourite refreshments are offered. Court ceremonials are especially prolix, as well as offensive and abasing to Western notions of propriety. British envoys have had stoutly to resist their observance, and have only conquered by accepting the alternative of refusing to approach the footstool of royalty rather than comply with them. The shah is honoured by his subjects as *Kibla-e-Alem*, which some render "centre of the universe," and others, "point of the world's adoration." But with all their respect for forms and ceremonies the Persians are not a formal people, but highly cheerful and social, applying themselves to recreation with an appetite apparently sharpened by the occasional restraints to which their customs condemn them. Their houses, even those of the wealthy, are generally built of mud or earth, and have only one storey. They are grouped together without any regard to uniformity or order, and are generally surrounded by high blank walls. The interiors are, however, often most gorgeously furnished; and although their being constructed of mud gives them a contemptible appearance, that material is perhaps better suited to the climate than either wood or stone. The miserable appearance of the towns is also much improved by the gardens which surround them, the Persians generally taking great delight in flowers.

Language and Literature.—The history of the language of Persia, like that of the empire, may be divided into various periods, since under each of the dynasties of which we have any remaining monuments there was apparently a change in the dialect of the kingdom. It has been supposed, though not without dispute, that the Zend was the prevailing dialect in the infancy of the empire; but the Zend must have fallen into disuse at a very early period, since, in order to propagate the religious tenets of the "Zend Avesta," the priests deemed it necessary to have the work translated into Pehlvi. As to the Pehlvi, it was at first spoken nearly at the same time as the Zend, and attained to a high degree of perfection under the Sassanian kings. Indeed it was the common language of the nobility and the court until 351, when it gradually fell into disuse, and made way for the Parsi, or the idiom of Parsistan (Persia Proper). It is believed that the Zend, as well as the Parsi, has a common origin with the language of the Brahmins, while the Pehlvi is closely related to the Chaldaic. After the conquest of Persia by the Arabs, Mohammedanism became the prevailing religion, and Arabic by degrees the language of the learned. At first it was cultivated for the purpose of reading the Koran. The addition not only of words, but of whole sentences, soon became a necessity; and thus the modern Persian arose out of a combination of Parsi with Arabic. The modern Persian, though neither so rich nor so expressive as the Arabic, is more harmonious and better suited to all kinds of poetry. The prophet Mohammed was once heard to say that "the language of Persia would be spoken in Paradise, owing to

its extreme softness." In the simplicity of its grammar it has been compared with the English; in its power of compounding words, with the German. The characters are the same as the Arabic, with the addition of four letters with three points. The Persian books are generally written in the sort of hand called *taalik*; although it is not uncommon to meet with words written in the *nekhi*, as the hand used by the Arabs is commonly called.

The literature of which the Magi possessed, until the introduction of Islam, has scarcely anything to show in its old dialects, the Zend and the Pehlvi, but some portions of the books of Zoroaster, the commentaries upon the same, and the Persepolitan inscriptions, which are for the most part unintelligible. The *Dei* or *Parsi*, after it became the language of the court, was very much cultivated by the Sassanian kings and their viziers, many of whom published works in it. During the first two centuries after the Mohammedan conquest, Persian literature made very little progress under the caliphs, who gave the preference to the Arabian. But when the power of the Abbasides began to decline, a number of independent princes arose in the different provinces of the empire, who vied with one another in promoting the cultivation of letters. This flourishing state continued until the beginning of the thirteenth century, when the invasion of Genghis Khan gave a violent shock to all the arts of peace. The Tartar and Turkoman dynasties rather encouraged than depreciated Persian literature, which in the sixteenth and seventeenth centuries, under the bloody reigns of the sultans of the house of Sefi, sank to its lowest state. Even the language was corrupted, and borrowed some of its terms from the Turkish, which was commonly spoken at court. Literature, however, seems to have somewhat recovered of late years.

Religion.—The vast majority of the inhabitants are Mohammedans, the total number of dissenters not amounting to more than about 74,000. The latter consist of Armenians, Nestorians, Jews, Guebres or Parsis. The Armenian population is estimated at 43,000; the Nestorians—including both Protestants and persons who have joined the Roman Catholic Church—at 23,000; the Jews at 19,000; and the Guebres at 8,000.

The Mohammedans of Persia are of the sect called Shiites or Shiabs, differing to some extent in religious doctrine, and more in historical belief, from the inhabitants of the Turkish Empire, who are called Sunnites. The Persian priesthood consists of many orders, the chief of them at the present time being that of *Mooshtehed*, of whom there are but five in the whole country. Vacancies in this post are filled nominally by the members of the order, but in reality by the public voice, and the shah himself is excluded from all power of appointment. Next in rank to the *Mooshtehed* is the *Sheik-ul-Islam*, or ruler of the faith, of whom there is one in every large town, nominated by the government. Under these dignitaries there are three classes of ministers of religion: the *Moottelle*, one for each mosque or place of pilgrimage; the *Muezzin*, or sayer of prayers; and the *Mollah*, or conductor of rites.

The Armenians are under two bishops, one of them Roman Catholic, and both residing at Ispahan. Wide tolerance is exercised towards Armenians and Nestorians, but the Jews and Guebres suffer much oppression.

History.—The kings of Persia in the classical Hellenized period used to derive their birth from *Perses*, the eldest son of *Perseus*, the slayer of the Gorgon, horn to him by Andromeda in Africa (Ethiopia). But there is not the slightest doubt that the present *Parsistan*, i.e. the *stan* or land of *Fars*, gets its name from the Old Persian *pars*, a horse or horseman. Ancient Persia (or, as it was usually called, *Persis*) was a small tract of mountainous land inhabited by a mixed Aryan people, and lying on the north-east shores of the Persian Gulf, the

only level piece of the whole territory being the strip of coast (Persis paralia). Every variety of climate was included in this little kingdom—cold mountainous regions, temperate middle slopes, and hot sandy plains by the side of the sea. The people called themselves *Arga*, that is "the noble," the word whence we get our name for the collective designation of Indo-Germanic races. When first known of in history they are found as fire-worshippers, that is, accurately, followers of Zoroaster, like the neighbouring nation of Medes; but the hardy habits of the Persian mountaineers made them in all other respects than this of religion very different to the luxurious Medes. The latter, about B.C. 668, by weight of numbers brought Persia into an uneasy subjection for about a century; but at this time, B.C. 559, the young Persian Cyrus (*Kuros*), whose mother was the daughter of the Median king, raised a revolt, and not only freed his country from its long subjection, but raised it to the supremacy. His power was now more manageable than any in Asia, the Persians giving him excellent soldiers, and the wealth of Media supplying ample material of war. He found two great monarchies to the westward of him, that of Babylonia and Assyria, and that of Lydia and Asia Minor. The latter was his first prey, and King Croesus (*Kroisos*), whose wealth has passed into a proverb, soon yielded to his arms, B.C. 546. Pressing forward to the sea-coast his generals annexed all the Greek cities of Asia Minor. Cyrus next attacked the Assyrian Empire, and by diverting the course of the Euphrates was able to enter Babylon, its capital, B.C. 538. The whole of Asia Minor, Syria, Mesopotamia, and Persia (in the modern extended sense) were now his. But the lust of conquest was insatiable. He turned eastward and conquered race after race of savages, falling at last in an attack upon the Massagetae, who dwelt in the neighbourhood of the Sea of Aral, B.C. 529. Cyrus the Great was succeeded by the half-insane Cambyses (*Kambyses*), who added Egypt to the empire during his reign of seven years. In 522 a deliberate attempt at imposture was made on the part of a Magian priest, who produced a false prince Smerdis, brother of Cambyses. The latter hurried from Egypt to oppose him, but being wounded and very ill died on the way.

After a few months the Persian leaders chose one of themselves, Darius (*Dareios*), son of Hystaspes, as king, who soon justified his election by restoring order. He made many expeditions, failing against Scythia (modern Russia) and against European Greece, succeeding against Kurênê (westward of Egypt) and against Thrace (modern Roumelia) and Macedonia, and on the far east also annexing the valley of the Indus. Darius therefore saw the Persian Empire at its greatest extent. In Europe he possessed Thrace and the Greek cities north of the Euxine; in Africa Egypt and Kurênê; in Asia, all Western Asia, with Bactria and Sogdiana on the north, and the Hindu Kush, Punjab, and Scinde on the east. This superb empire Darius divided into twenty satrapies or viceroalties, and organized the whole in a most remarkable manner, which may be studied yet in the pages of Herodotus. The Ionian cities in Asia Minor revolted in 501, and as they were assisted by the Athenians, Darius ordered the latter also to be added to the list of his slaves. His general, Mardonios, led a large army into Europe in B.C. 492, but was overtaken by a storm and lost his fleet, and wasted much energy against the hostile Thracians. He was replaced by Datis and Artaphernes, who were more fortunate, reducing the island of Euboea, whence they landed in Attica on the plain of Marathon. Here they were totally defeated by the Greeks under Miltiades (B.C. 490). Darius was furious, and proposed to call out every soldier he had rather than be bearded by a handful of Greeks. He spent three years in preparation, and at his death, in 485, charged his son Xerxes with the execution of his plans. Xerxes started

with an army which is said to have amounted to 2,500,000 fighting men, in the spring of 480. He had some trouble at the pass of Thermopylae (*Thermopylai*), a name rendered immortal by the heroism of Leonidas, but eventually entered Athens. Here he found a deserted city; the Athenians had removed their non-combatants, and the fighting men were away with the fleet. This fleet soon inflicted a crushing defeat on the Persian armada at Salamis. His entire fleet lost, Xerxes became alarmed, and almost hurriedly began the retreat to Asia, leaving Mardonios with 300,000 troops to finish the conquest. In 479 Mardonios suffered a severe defeat at Plataiai, and by 478 the capture of Sestos on the Hellespont saw the last Persian conquest in Europe regained. Xerxes was murdered in B.C. 465 by the usurper Artabanus; but Artaxerxes, called the "Long-handed" because his right hand was larger than his left, succeeded his father Xerxes after a few months. He reigned from 465 to 425; and saw the great artificial construction of Darius, which sought to hold together some fifty nations by bonds of common government, begin to crack and crumble during his long reign. Egypt revolted, and only part could be reduced to obedience. The Athenians also severely handled the Persian fleets in the Mediterranean, so that the great king had to make very disadvantageous terms to keep them quiet. The son and successor of Artaxerxes I., Xerxes II., was murdered by Sogdianus his illegitimate half-brother; and the latter after a brief reign fell in his turn before his brother Ochus.

Darius II. (the name assumed by Ochus) is often called *Dareios Nothos*, i.e. the bastard, to distinguish him from the great Darius. He married Parusatis, daughter of Xerxes I., and had two sons, Artaxerxes II. who succeeded him, and Cyrus. In his reign (424-405) Egypt was entirely lost. Artaxerxes II. (405-359), called Mnémon on account of his excellent memory, on his accession found his brother Cyrus engaged in plotting against him, with the help of Queen Parusatis. Cyrus was satrap of part of Asia Minor, and so was in intimate connection with the Greeks. He engaged 10,000 Greek mercenaries, when he at last determined to make war on his brother; and after his fall at Kunaxa, near Babylon (B.C. 401), the famous "retreat of the 10,000," or the *Anabasis*, was undertaken by the Greeks, and is made memorable to all time in the pages of Xenophon, general-in-chief of the force during the last part of the time. The Persian Empire was now thoroughly weak, splendid as it seemed; and had the Greeks been united they could have shattered it completely. But this was a time of profound disunion in Greece, for Athens had fallen at the close of the Peloponnesian War (B.C. 404), and no steady foreign policy could be maintained. Consequently the constant wars between the Greeks and the western satraps of Artaxerxes ended in the peace of Antalkidas (B.C. 387), very greatly in the Persian king's favour, for he received definitely the sovereignty of all the Greek cities of Asia Minor and of Cyprus, and Athens retained only the islands Lemnos, Imbros, and Skiros. As for Cyprus, its satrap almost at once revolted, and the struggle lasted from 385 to 376. Other satrapies also revolted, and the reign closed gloomily. As a fitting termination, Ochus, son of the king, deliberately killed off all his brothers to secure the succession for himself. His wickedness succeeded better than it deserved, and he reigned as Artaxerxes III. (or *Artaxerxes Ochus*) from 359 to 338. His first act was to kill all the rest of his family; he was intensely cowardly and brutal, and greatly influenced by eunuchs, whom he used as his ministers of state. He had the fortune to secure good Greek generals and mercenaries, however, and by their means reconquered Egypt (350), Phœnicia, and Cyprus. At last his personal crimes brought about his murder by Bagoas, a favourite eunuch (B.C. 338), and his son Narsēs succeeded him. But when Narsēs attempted to shake

himself free from Bagoas, the same poison which killed his father was ready for him also. Bagoas now raised to the throne Kodomannos, a descendant of Dareios Nothos, who took the title of Darius III., and who was the last king of Persia. His reign began B.C. 336, and almost at once he had to defend himself against Alexander, the young king of Macedon, who had sworn to free Asiatic Greece from Persia. The severe defeat at the river Granikos (334) showed Darius III. the force of his enemy. He strained every nerve to assemble a powerful force, but only to meet with a complete overthrow in the plain of Issos (333). His mother, wife, and children fell into the conqueror's hands; but, to his honour, he treated them with great respect. Darius himself fled over the Euphrates, and in the course of two years found himself once more at the head of a huge force, this time probably 1,000,000 men. The armies met near the Tigris, at Gangamela, October 331, and the Persians were utterly defeated and pursued for 50 miles in the most hopeless disorder by Alexander, as far as the town of Arbela, which generally gives the name to the battle on this account. Darius escaped to Media, and lay hidden. Alexander heard of him as again endeavouring to concert a rising in the next year, and dashed upon him. Darius fled through the Elburz Mountains, "the Caspian Gates," into Parthia. The satrap there, Bessos, murdered his fugitive master; but Alexander regained the body, and in his usual generous fashion buried it with due honours at Persepolis, in the tombs of the kings.

Persia retained some amount of national feeling during the break-up of the Alexandrian Empire; and though it eventually fell, first to the Seleucid kings of Syria, then to the kings of Bactria, and lastly (246 B.C.) under the dominion of the Arsakid Empire of Parthia (the modern Khorassan), it clung together and was able almost with ease to shake off the foreign yoke after about five centuries of subjection, and once more rose to independence. The leader was a grandson of a certain Sassan; and hence, though his own name was Ardashir (called by the Romans Artaxerxes), the dynasty which he founded is called that of the Sassanids. The revolt of Ardashir was crowned with success in A.D. 226, and his descendants held the throne till A.D. 651. Ardashir at once began his reign by re-establishing the pure religion of Zoroaster, and the symbolic adoration (by no means worship) of fire. He then put to death the chief members of the Arsakid royal family of Parthia, and very swiftly gained complete authority. As soon as this was done he inaugurated the perpetual conflict with Rome, which was destined to last through the whole dynasty, by demanding from Alexander Severus all the ancient territories of Persia. Of course war was the only possible consequence, and the fight thus begun lasted for centuries. Shapur (Sapor I.), successor of Ardashir, actually captured the Emperor Valerian, who died in captivity. In this king's reign lived the famous Mani, who founded the sect of the Manicheans in his attempts to reconcile the religion of Zoroaster with that of Jesus Christ, and who met from the very first with persecution from the votaries of both these faiths. He was put to death by the following king, Bahram, with whom we otherwise are familiar as the "Varanes" who gave so much trouble to Zenobia, queen of Palmyra, and to her conqueror, the Emperor Aurelian. In 297 Narsès was considerably worsted by the generals of the emperor of his day in the course of the secular conflict; this was the energetic Diocletian, and his splendid prize was Mesopotamia, Armenia, and other provinces. Shapur II. (Sapor the Great), 310-381, who was crowned upon the death of his father, while yet in his mother's womb, the Magi placing the diadem solemnly upon the body of the widowed queen, was one of the most powerful enemies of the Romans. The Emperor Constantius II. was repeatedly defeated, the Emperor Julian fell in battle against him, and the Em-

peror Jovian was forced to give up Armenia and other provinces for the sake of peace. Bahram (Varanes V.), 420-448, is another noteworthy sovereign of the Sassanids, partly because of his ferocious persecution of the Christians, who fled by thousands into the Roman territories, and partly because of his wars against the Huns, the Turks, and the Indians, which have made him almost the favourite legendary hero of Persian poetry. He died by riding into a deep well, and neither he nor his horse was ever seen more. Perhaps the greatest of all the Sassanids was Khosru (Chosroes), surnamed *Nushirvan*, "the Generous" (531-579), the famous opponent of Justinian. He even enforced a yearly tribute of 440,000 pieces of gold from the Byzantine emperor for several years, and a reduced tribute of 40,000 for several years more; his empire reached from the Indus to the Red Sea, and over large tracts of Central Asia. He was, moreover, a great patron of literature, and had all the best Greek, Latin, and Indian works translated into Persian. A later king of the same name, Khosru II. (Chosroes Parviz), 590-628, was a remarkably successful warrior. After conquering Mesopotamia, Syria, Egypt, and Asia Minor, he prepared to cross to Europe, and pitched his camp at Chalkedon, almost in sight of Constantinople, on the Asiatic shore. But the Emperor Heraclius came to the rescue, drove Khosru back, and in a splendid series of campaigns carried the Byzantine arms into the heart of Persia. Khosru had lived six years too long for his fame. He was assassinated. His son and successor Shirweh (Siroes), in the peace which he made with Heraclius (628), restored the Holy Cross which his father had carried off at the conquest of Jerusalem, and which the emperor held in the greatest reverence. Shirweh died after a reign of only eight months; his son, an infant, Ardashir III., was almost at once put to death, and with him ceased the long line of Sassanid kings of Persia (628).

A few kings and queens hurriedly succeeded one another in the anarchy which now prevailed; and the last of these, Yezdijird III., was defeated in 636 by the famous Khaled, general of the second caliph, Abu-Bekr, father-in-law and successor of Mohammed. A temporary revolt in 650 was followed by the assassination of Yezdijird, 651. Henceforth Persia was a Mohammedan country, and for more than two centuries after this event its national history presents an entire blank. The Persians imbibed the religion and literature of the Arabs, to whom they imparted in return their civilization and luxury; but the country was only a province in the empire of the caliphs, and followed implicitly the revolutions of the Ommyades and Abbasides. With the decay and division of the power of the Commanders of the Faithful the spirit of independence revived, and the re-establishment of the kingdom may be dated from the foundation of the Saffarian dynasty by Yakub Ibn Laïs. This dynasty lasted from 868 to 900, and was succeeded by the Tartar Samanides dynasty (900 to 936), and a native dynasty (936 to 1028). The Seljuk Turks, among whom were the distinguished kings Toghrul-Beg and Alp-Arslan, ruled Persia thence till 1194, when the Kharismians held the reins of power for a short time. The famous Mogul Genghis Khan established a new dynasty, which ruled Persia till 1381, in which year the Tartars under Tamerlane conquered the country, and established a rule which extended, with few interruptions, till 1502.

Ismael Shah, the founder of the Sefi, Sufi, or Sefiavean dynasty, was remotely descended from the Caliph Ali, the cousin and son-in-law of Mohammed. He was a Turkoman, but he belonged to a different religious sect from the Turks usually so called, and hence the national hostility which has subsisted between the Persian (Shiah) and Turkish (Sunnite) Mohammedans. This dynasty lasted from 1502 till 1736; it included the distinguished

name of Abbas the Great, under whom the Persian Empire regained much of its former extent and splendour. The Sefi dynasty was put an end to by Nadir Shah, in 1736, at whose death, in 1747, the empire was plunged into civil discord, which continued till 1795, when the Kajar (present) dynasty was founded.

In 1873, and again in 1878, Nasr-ed-Din, the shah, visited most of the European capitals, and it was hoped that the result would be the introduction into Persia of the modern arts and sciences, and above all, a better regulated system of justice and finance. Very few material improvements have, however, resulted from the tours.

PERSIAN ARCHITECTURE. The first trait that strikes one on looking at any sketches of ancient Persian architecture, such as those given in the Plate illustrating this article, is the marked similarity in many essential points to the constructions of Nineveh and Babylon. Walls sculptured with bas-reliefs and vast terraced structures remind us perpetually of Assyria. The reason is that the great empire of Babylon was overthrown by the Persians, under the great Cyrus, in 538 B.C., and as so often happens with conquered peoples of a higher civilization (for instance, with the Greeks as regards the Romans), their arts subdue the minds of their barbarian conquerors, whose prey their lives and fortunes still remain. But even for two centuries before this the Medes, then the lords of the Persians, had been thoroughly permeated by Assyrian and Babylonian influence. Consequently we look to the old Persian architecture to explain away the puzzles of Nineveh and Babylon. What was wanting in the great cities of the plain, viz. building stone, was plentiful at Persepolis; and therefore, while only the alabaster facing-slabs of the Assyrian fallen brick palaces remain to us, considerable structures in stone yet partly exist in Persia. Especially valuable are these with regard to their columns, some of which are shown in the Plate, because all the Assyrian columns, which were of wood, have perished utterly, leaving no trace behind, and the fallen roof of earth has crumbled into indistinguishable dust. The great ruins of Persepolis, with the famous hall of the forty pillars, might perhaps have remained almost intact to us had not the drunken folly of Alexander the Great destroyed the palace. The ruins rise in terraces at the foot of Mount Rachmed, and are constructed of the blackish-gray marble of the mountain itself. They measure 1400 feet by 500, and are believed, on the strength of the numerous inscriptions in Persian cuneiform, to be due partly to Darius and partly to Xerxes.

While we thus realize the debt of ancient Persia to Assyria, it is clear that the debt of classical Greece to Persia is great also; and the evident kinship of many of the forms (see, for instance, the Ionian volutes in the capital of the tall column) is explained when we remember the intercourse that Greece enjoyed with Persia, and when we consider that the great period of Greek architecture came immediately after the Persian War. It was a habit of both Darius and Xerxes to use Greek artificers, and these men, returning home, would take with them all the consummate knowledge of centuries stored by the Assyrians and Persians.

Under the Sassanian revival of the Persian Empire the architecture took on at first many Greek characteristics, but it gradually changed, especially by introducing the round arched window, &c. It became quite Sarsenic in tone towards the close of that period. Especially characteristic of Persian Sarsenic is the curious arched doorway, the opening of which is the shape of half an egg standing on its narrow end.

PERSIAN GULF. The Green Sea of Oriental writers, an extensive arm of the Indian Ocean, separating Persia from Arabia. It is united with the ocean by the Strait of Ormuz, which in the narrowest point is 38 miles wide. The general form of the gulf is that of a curve, the convex side of which is turned to the south-west. The greatest

length in a straight line is about 650 miles; the width varies from 55 to 250 miles; the area, including the islands, is 117,300 square miles. The shores on both sides of the gulf are almost everywhere arid and sterile, and whether belonging to Persia or Arabia, are inhabited mostly by Arabs. The places which are most resorted to by shipping are the anchorage between the island of Ormuz and the town of Gombroon, the small bays of Mogoo and Bende, Chetwar, the roadsteads of Bushire, and north of that town, the bay of Jenabe and Ras Dilem.

The most remarkable of the numerous islands which are dispersed along the shores of the gulf are Ormuz, Kishm, Kaes, Busheab, Bahrein, and Karez. Kishm is the largest in the gulf, being 70 miles long, and in the broadest part 20 miles wide. The islands of Kaes, Busheab, and Karez are small.

Fish abound along the shores, and, with dates, constitute the principal articles of food of the population, nearly the whole of whom, on the Arabian shores of this sea, get their means of subsistence by the pearl-fisheries. The pearl oyster is found in all the waters up the gulf, but the best beds are on the Arabian side between 24° and 27° N. lat., at a distance of from 1 to 90 miles of the shore. The British protectorate, which has of late years been extended over the gulf, insured the peaceful prosecution of this industry; piracy has been abolished, and intertribal difficulties are referred to the British resident, whose decision is final. It has been surmised that at one time the Persian Gulf was connected with the Mediterranean.

PERSIAN WHEEL, in mechanics, a wheel turned by a stream for the purpose of raising water above its ordinary level. To the rim of the wheel a series of hinged buckets is suspended, which, as the wheel goes round, plunge into the water and are duly filled; and on their rising to the required height, they are made to strike against some kind of obstacle in such a manner as to overset and pour their contents into a trough or other receptacle. This primitive water-wheel is much used in Egypt and the East.

PERSIM MON. See EROXY.

PERSIUS (Aulus Persius Flaccus), the Latin poet and satirist, was born at Volaterra, in Etruria, A.D. 34, and died at Rome A.D. 62, at the early age of twenty-eight. He was of noble family, and familiar with all the literary men of his day, Lucan, Petronius, Seneca, &c. He had no inducement to hurry over his work, being wealthy and not vulgarly ambitious; consequently he wrote very slowly, and thought no pains too great. We have a little over 600 lines only from his pen, in the form of six satires. These attracted the greatest admiration upon their appearance, and have been favourite poems down to our own time, though not so much appreciated by ourselves as by the ancients. We know that the life of the young Roman was such that he was able without impropriety to satirize the follies and vices of the corrupt society around him, he almost alone remaining pure. Persius is a difficult author, full of far-fetched allusions and strange terms, but intensely dramatic and forcible, and occasionally graceful. The *editio princeps* appeared at Rome in 1470: the best edition is the scholarly work of Heinrich (Leipzig, 1844). Otto Jahn, in Germany, and Professor Conington, in England, have also edited Persius more recently. Dryden's translation is well known, and though not so faithful as some others, must always be admired.

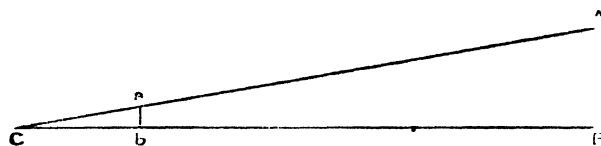
PERSONALTY or **PERSONAL ESTATE**, a legal term, meaning the property which, when a man dies, goes to his executor, as distinguished from the realty, which goes to his heir-at-law. The latter consists of freehold land, houses, &c., while personality is money, furniture, stock, and other movables.

PERSPECTIVE is the art of representing solid bodies on a plane surface; which at once falls into two divisions, according as we wish to show the apparent forms of objects

by their perspective outlines (linear perspective) or the distances of objects by their relative brilliancy of colour (aerial perspective). The latter is accomplished by the painter or the draughtsman with skilful gradation of the strength of tints or lines, the more distant objects being expressed by fainter tones, and needs no further mention here.

Linear perspective, the subject of this article, is wholly based upon the properties of similar triangles.

Thus if AB be a tree half a mile off, and ab a pane of glass near the observer c , the height of AB will be to the



height of ab , its image, as the distance cb to the distance cB . If then the line ab be drawn on paper and held at a distance from the eye equal to that of the point b , it will exactly represent the appearance presented to the eye by the height AB , which in nature is at the distance n . It is exactly the same thing with widths as with heights; and if we consider the figure as a plan, not as an elevation, and AB as a length of wall, then ab will be, under the given circumstances, its perspective delineation. It becomes thus possible to represent a large distant effect quite accurately, even to a matter of nice calculation, upon a small surface held near the eye, and representing a transparent plane through which the distant object is seen.

Things grow smaller in appearance the further off they are. Thus ab represents the distant AB , but if AB were as near the eye as ab , the visual angle (the angle at c) would be enormously increased. Moreover, this lessening is progressive and uniform. Therefore, if objects of equal height, but at varying distances, are to be represented as they appear to the eye, *i.e.* in perspective, they must be drawn of different heights, the nearer ones higher than the more remote; and the same remark applies to width. Any one drawing a row of trees seen through a piece of fine tissue paper held against a window-pane, can verify that this is actually the appearance seen by the eye. Perspective is the art which teaches how to secure the correct amount of diminution, and thus to attain a truthful delineation.

Many have asserted that since things apparently lessen as they recede from the eye, this should hold good vertically and laterally. A row of tall masts, such as are used for bearing banners at a festival, ought according to these wisemen to look thus, if one were to stand before the



A row of equally tall masts.



Supposed perspective appearance.

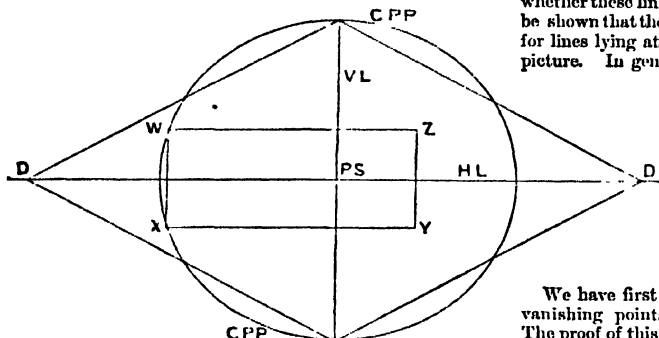
central mast. Perhaps they ought, and certainly in photographs of such things, and of large buildings also, the lines do converge when they rise considerably above the horizontal line; but what is quite sure is that whether or not they ought, they do not so appear to the eye. Again the test of drawing on the window-pane proves the truth of the assertion. Vertical lines, then, standing in a line parallel to the plane of the picture, and covering from extreme to extreme not more than an angle of 60° (the limit of comfortable vision), are to be represented as not diminishing and as not slanting, but as retaining their verticality and their equality.

The angle of 60 degrees has been mentioned as the extreme limit of accurate vision; and this field of sight must be felt as circular in outline and as conical in figure, a great ever-widening cone which forms in section a triangle whose sides make an angle of 60 degrees with one another, and whose apex is the eye. The best way to show this natural fact is to take a colander of spherical curve, and pass longish wires through its holes; then if one draws the wires to a point inside the colander, representing the focus within the eyeball, the portions of the wires without will radiate conically, and can easily be made to do so at an angle of 60 degrees. In this experiment the colander represents the ball of the eye, and the wires the rays of light reflected from external objects, and carrying with them as they pass in to the eye, to fall upon the retina, the images of those external objects. The plane of the picture may be placed at any distance chosen along this cone of sight. If the whole view is to be given, the picture must be circular or square (the corners of the square touching the circular section of the visual cone); but, as a rule, a picture gives only a portion of the entire view, and this portion may be taken from any part of the field desired, provided always that the picture does not extend beyond the circular section of the visual cone at any part. It is assumed that the two eyes act as one, and that the view once fixed the objects are fixed, and the eyes fixed also; for if they were to travel here and there, the visual angle or visual cone would of course travel too, and the whole calculation be disturbed. As a matter of fact the eyes do not act as one—the right eye sees more of the right side of an object, and the left more of the left side, a fact taken advantage of in the STEREOSCOPE, but one which must necessarily be neglected in a picture.

These facts admitted, the following points are necessary to be admitted also, following, as they do, more or less from the first. (1) The position of the eye of the draughtsman, and of the spectator after the drawing is done, is always opposite the centre of the circular section of the visual cone of rays, which forms the *plane of delineation* or *picture plane*. This position of the eye is called the *station-point*, and the centre of the circular picture plane is called the *point of sight*; the ray joining the two being the *principal visual ray*, and travelling directly forwards from the eye, as the axis of the visual cone. (2) The horizontal diameter of the circular picture plane, that is, the diameter horizontally opposite to the eye (station-point) and passing through the point of sight in the plane of delineation, is called the *horizontal line*. (3) The triangle made by any diameter of the circular plane of delineation and the extreme rays of the visual cone, with the eye as an apex, is of course an equilateral triangle (each of its angles being 60 degrees). Imagine such a triangle formed on the vertical diameter of the circular plane of delineation. Fold it down to the right, and then again to the left, turning upon the vertical diameter as upon a hinge, and the *points of distance* are laid down. These points evidently lie on the horizontal line produced. It is manifest that when these lines and points are all fixed, any particular portion of the whole field of vision, such as $w \times x \times z$, may be taken, lying not at all symmetrically with that field, but so that all its perspective lines will be dominated by the fixed lines and points of the whole field, and not by lines and points fixed in reference to itself. Thus, the point of sight is the centre of the visual field, but it need by no means be the centre of the picture; the points of distance are equidistant from the point of sight, but as in the illustration, they may be by no means equidistant from the centre of the picture, nor need the horizontal line be in the middle of the picture, &c. Yet every true picture must be drawn with these lines and points fixed in

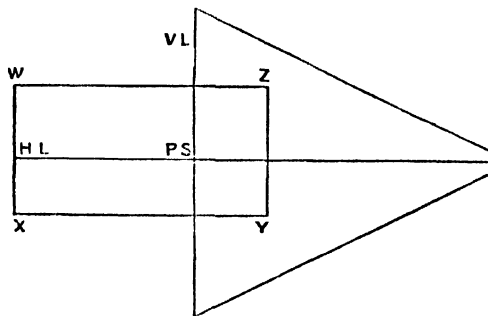
their true positions with reference to the circular plane of delineation, or it will be quite inaccurate.

In practice, therefore, we take our picture $Wxyz$ of any shape desired, fix our point of sight where we will, and through it draw our horizontal line. We next fix the relation our picture bears to the whole circular plane of



P S, Point of sight; O P P, circular picture plane, or plane of delineation (a section across the cone of visual rays taken at the same distance from the eye that P S is from V, the cone having 60° divergence); V L, vertical line; H L, horizontal line; b, b, points of distance (the actual position of the eye is exactly opposite P S); W X Y Z, outline of the proposed picture.

delineation. We may suppose it touches the circumference in x ; then through $r s$ draw a vertical line $v l$, measuring each way from $r s$ a distance equal to that from $r s$ to x . Upon the whole line $v l$ so drawn erect equilateral triangles,



and the points of distance, \mathfrak{D} , are fixed. It is observed that the assumption of the relative size and position of $w\ x\ y\ z$ to the whole field is free, but when once fixed all the rest rigidly follows.

Now, if we stood upon an enormous field of level ice, its most distant limit would appear to be level with the eye; and if we stood under a huge ceiling (as indeed we often do stand, beneath the clouds), the most distant limit would likewise appear to come down to the level of the eye. The aeronaut sees the earth beneath him as concave, a huge basin—not as convex, a huge ball. We say, then, that horizontal planes converge to the horizontal line.

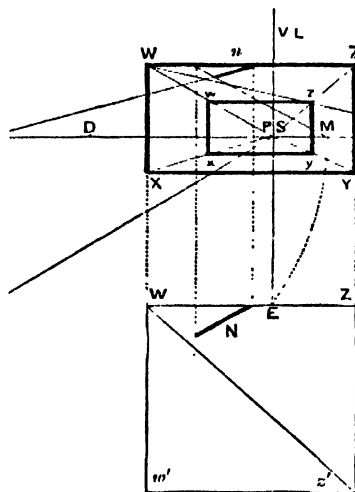
Further, the same holds to hold with vertical planes relatively to the vertical line; and since the horizontal and vertical lines meet in the $F.S.$, we may say also, as a general deduction, that all lines perpendicular to the plane of the picture in nature converge to the point of sight in the perspective representation of it.

But all lines are not so perpendicular; many are parallel

to the picture—and these, though they shorten as they lie further and further off, do not converge at all; others are oblique, and they converge towards other points than the point of sight, such points being called *vanishing points*. The point of sight is therefore describable as the vanishing point of lines perpendicular to the plane of the picture, whether these lines lie in vertical or horizontal planes. It will be shown that the points of distance are the vanishing points for lines lying at an angle of 45 degrees to the plane of the picture. In general, all lines lying at any given angle with

the picture plane (i.e. lines parallel with each other) have the same vanishing point, to which all these parallels converge; and the vanishing point differs for every different angle, that is, for every different set of parallels. But lines, whether vertical, horizontal, or oblique, which are in the picture plane itself, or which are parallel to it, have no vanishing point, and appear at their proper angles in perspective as they really occur in nature.

We have first to show that the points of distance are the vanishing points for all lines at an angle of 45 degrees. The proof of this brings us to the knowledge of another line, the *base-line*. Let, for example, $w\ x\ y\ z$ be the picture, which is, as before said, a portion, chosen at will, of the circular picture plane or plane of delineation, and let the radius of this circular plane and the situation of the horizontal line, $u\ l$, and the point of sight, $r\ s$, be as before. Then, also, the points of distance will lie at v , p , as before; and these things are not matters of convention, but are fixed by the data given. Now let the problem be to give a perspective representation of a room with a square floor, and for simplicity's sake let one side of the room be identical with the size of the picture; then $w\ x\ y\ z$ represents the nearest side of the room to the spectator. Now if w



draw a line n, z , and take a part of it, $w' z'$, exactly opposite to $w z$ in the proposed picture, and on this $w' z'$ draw a square $w' w' z' z'$; we shall have a geometrical plan of the ceiling of the room. We know that the perspective lines $w' w' z' z'$, take the directions $w w z z$ in the picture, since they run towards the point of sight. The difficulty is how long these lines are to appear in perspective, that is, for instance, where the point z should come on the line in the picture from z to $r s$. It is evident that this could

be found if we knew the perspective representation of the line $w'z'$, for this would at once give us z at the point of intersection with the line from z to r s. Now we have taken n l. (the *base-line*), as it were, at random, but it is in truth accurately fixed from the original data. It must be remembered that the points of distance represent the distance of the picture plane from the eye, which is opposite to r s, and at the distance that r s is from D . Now let r s for the moment stand for the position of the eye instead of the point of sight (which is opposite to it), and from r s draw a line to the point x perpendicular to the line h l, and representing the principal visual ray—that is, equal to the distance between r s and D . Through the point x draw the *base-line* n l., parallel to the horizontal line. Now n l. is, by the construction, at the distance of the picture from the eye, and the plan $w'w'z'z'$ therefore represents the actual geometrical plan of the ceiling by measure, extending from n l. onwards into the picture, the lines extending downwards on the drawing standing for the lines extending inwards away from the eye in nature. Since all parallel lines have the same vanishing point, we can find the vanishing point of any line lying at any angle whatever to the picture plane when it is delineated on the geometrical plan based upon the line n l. To do this we draw a parallel to it from the point r s to the line n l., and then, as this line merely represents for constructive purposes the horizontal line n l., we vertically transfer our vanishing point thus found on n l. to the line h l., where we can use it for perspective work. For example, let n be any line on the ceiling of the room not parallel with the picture plane; n may be a part of some design on the ceiling, or the upper edge of a partition, &c. Then the vanishing point of n is found by drawing a line from r s to v parallel to the line n , and then vertically transferring v to V , the corresponding point on the horizontal line. Then the perspective representation of the line will be along the line v n in the picture.

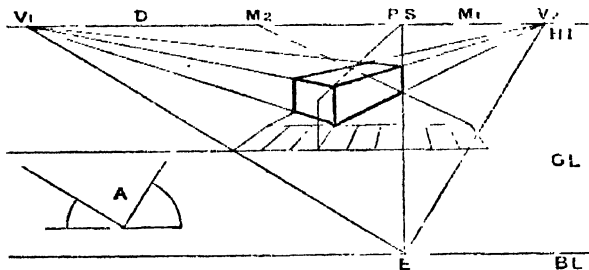
Using this general law for the particular angle of 45 degrees, which is the angle the diagonal of a square makes with the sides, we find the perspective vanishing point of the actual line $w'z'$ of our plan (lying at 45 degrees to n l.) by drawing a line from r s to d , a point on n l., parallel to the line $w'z'$, and then transferring the point d vertically to D , a point on the horizontal line. But we shall find that we have arrived at D , one of the points of distance; and the reason why is sufficiently obvious, for the distances r s to D and r s to x are equal, and the angle at r s is a right angle, therefore the four-sided parallelogram, of which these sides and this angle are a part, must be a square. The points of distance are therefore the vanishing points for all lines at an angle of 45 degrees to the picture plane; the point of sight for all lines at an angle of 90 degrees (right angle), and the various vanishing points for other angles, are all found as above described.

The use of the points of distance as *measuring points* is now quite obvious; but it remains to find the measuring points for other vanishing points than r s; as, for example, for V , the vanishing point of the oblique line n . If we consider that D , the measuring point for r s, is at the same distance from it as E , that is, as the length of the line drawn from that vanishing point (r s) to the base-line n l., and parallel to the lines in the plan $w'w'z'z'$, then we see how to get the measuring point for the vanishing point V . We take, namely, the distance from r s to v (or which is the same, from V to x) as a radius, and with V as a centre describe an arc cutting h l. in the point M : and M is the measuring point for V . Throwing up a perpendicular from the inner point of n to the edge of the ceiling in the pic-

ture, we cut off a part of v n by a line drawn from the end of this perpendicular to the point M , and thus obtain the true length of the perspective line n , representing the actual oblique line n .

In actual practice it is evident that, regarding x v, the lower edge of our proposed picture, as resting on the ground, a *ground-line* might be drawn there, upon which all measurements might be set off just as well as upon the true base-line, avoiding the trouble of referring everything upwards by perpendiculars; but this is a matter of convenience and of saving space, and in no wise alters the principles already laid down. Further, as such a *ground-line* would naturally be about 5 feet below the eye, i.e. the horizontal line, we have here a natural scale of great use in constructing our measurements.

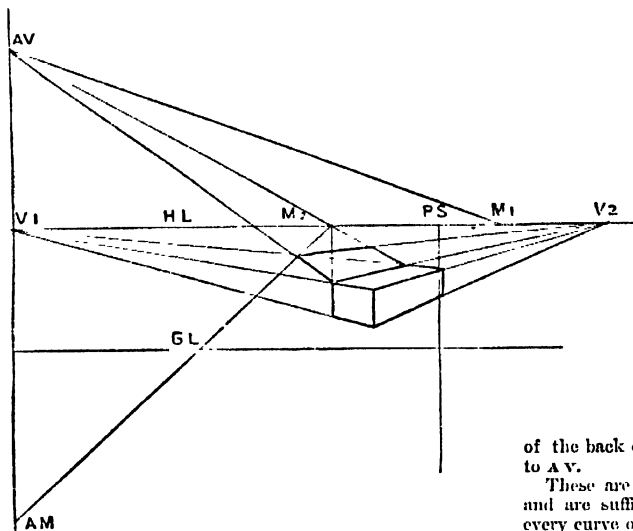
Hitherto our examples have been parallel to, and in contact with, the picture plane, but the same principles hold good for bodies turned obliquely and set within the picture. Thus, let it be required to draw a box 2 feet within the picture, standing on the ground, and its sides turned at a given angle, A , to the picture plane, the height of the box to be 2 feet, the length 6 feet, and the depth 3 feet, and the nearest corner 3 feet to the left of the eye. Having fixed the lines h l., v l., and G L. (*ground-line*), and laid down a scale of feet along G L, obtained by dividing the distance between G L and h l. by 5, as just explained, and having fixed the points r s, D , and E in the same manner as before, we proceed to construct an angle at r , exactly similar to the angle A , and by this means we obtain the two vanishing points, v l., v 2; then with r s as the extremity of the radii, and the vanishing points as the centres, we at once obtain M l., M 2, the respective measuring points. The first thing to do is to erect on the picture plane itself the nearest corner of the box, 2 feet high and 3 feet to the left of the line, from r s to x (the central visual ray); then we readily obtain a perspective representation of this 2 feet within the picture by the use of r s as a vanishing point and D as a measuring point. Through the foot of the corner line of the box thus obtained we draw a hori-



zontal line, which therefore lies 2 feet within the picture, and to this we transfer our scale on the line G L, which is on the picture plane itself, by lines running to r s. Were we not to do this we should be unable to get our measurements true for the box, for as lines lie further within the picture so are they smaller in their perspective appearance, and measurements true for the picture plane are too large for 2 feet within it. We now find the planes of the sides of the box by drawing lines from v l., v 2, to the top and bottom of the corner already found. We cut off 3 feet on the one side and 6 feet on the other, by drawing lines from the measuring points, M l., M 2, respectively to those distances along our new measuring line, 2 feet within the picture, and the box may be at once completed.

To pursue the subject further would be, with one exception, simply to accumulate details, the function of this article being limited to setting forth the principles of

the art. The exception alluded to is that of *oblique planes*. Suppose the box we have just drawn had a lid, open at a certain angle, Q , where would be the vanishing point for the edges of that lid? Not in the horizontal line, for it is not



referable to a horizontal plane, nor in the vertical, through rs , for it is not referable to a vertical plane at right angles with the picture plane. It is manifest that, as it lies somewhere in the oblique vertical plane, whose vanishing point is v , it must lie in the perpendicular line through v . If the lid lie back open, towards $v1$, then the *accidental*

ing-point for Δv , which may be called ΔM , is found as usual by taking Δv as a centre and the distance to $M1$ as a radius; it lies, therefore, on the perpendicular through $v1$ at the point ΔM , as shown in the figure. Join Δv and the two back corners of the box; this gives the lines of the lid, but not its dimensions. The lid must measure, as the box did, 3 feet across. We have, therefore, to set up 3 feet perpendicularly from the back of the box for the use of our measuring point, because while ordinary measuring points take horizontal measurements, *accidental measuring points take vertical measurements*. We know that the box stands 2 feet high, half the height of the box gives us therefore a scale of one foot at the distance of the back of the box within the picture; and we elevate a perpendicular from the back vertical edge of the near side of the box, making it 3 feet above the box by the scale at that point within the picture. A line from ΔM to the top of this perpendicular measures off 3 feet along the line from Δv to the back of the box, and so gives us the width of the lid. The upper and lower edges of the lid run of course to $v2$ (the lower of these being the top edge of the back of the box), and the two sides of the lid run to Δv .

These are all the fundamental principles of perspective, and are sufficient for the most elaborate drawing, since every curve or figure of any shape whatever can be brought into relations with a square or rectangle, and if it be drawn through certain fixed points in that square, &c., it can be reproduced in perspective by being drawn through the same points fixed relatively in the perspective representation of that square, &c., as in the figure.

PERSPIRATION, the special secretion of the SKIN, is dealt with in the article under that heading.

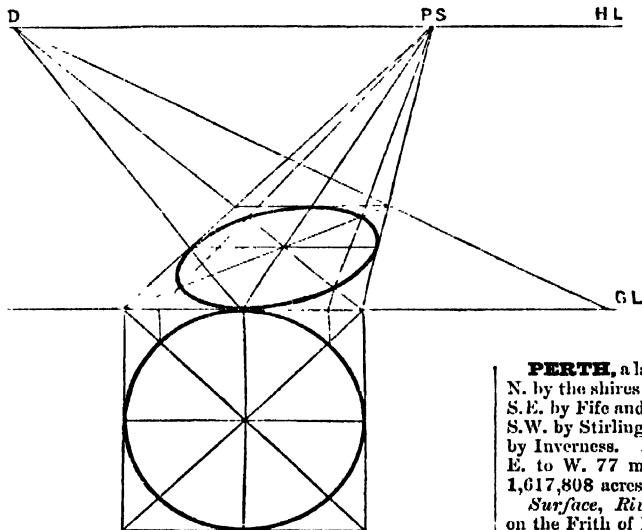
PERSULPHOCYANIC ACID.

an acid obtained from potassium sulphocyanate by acting on it with strong hydrochloric acid. It is a yellow crystalline powder, insoluble in cold water, soluble in boiling water, in alcohol, and in ether. The formula is $C_2H_2N_2S_3$. It decomposes at $200^\circ C.$ (392° Fahr.), giving off sulphide of carbon, ammonia, and sulphur. The persulphocyanates of the metals are mostly insoluble precipitates; those of the alkalis are soluble, and readily converted into sulphocyanates. Persulphocyanogen ($C_2N_2HS_3$) is an orange powder insoluble in water, but soluble in alcohol and ether, and also in strong sulphuric acid, from which it is precipitated unchanged by the addition of water.

PERTH, a large and central county in Scotland, bounded N. by the shires of Inverness and Aberdeen; E. by Forfar; S.E. by Fife and Kinross; S. by Clackmannan and Stirling; S.W. by Stirling and Dumbarton; W. by Argyle; and N.W. by Inverness. Its length from N. to S. is 68 miles; from E. to W. 77 miles. The area is 2528 square miles, or 1,617,808 acres, and the population in 1881 was 129,007.

Surface, Rivers, &c.—Excluding a detached district on the Frith of Forth, Perth is of a compact circular form, and is composed of hills and straths inclining to the river Tay. It is the most picturesque region in Scotland, offering great variety of surface, soil, and climate; while the population is part Saxon and part Gaelic. From the old red sandstone, in the lowlands, near the Ochils and Sidlaw

vanishing point of this lid, as it is called, will lie on the perpendicular through $v1$, and this point, Δv , is found by taking at $M1$ an angle equal to the angle Q , and producing the line to cut the perpendicular through $v1$. The measur-



Hills on the south-east, it rises towards the Grampians on the north and north-west. The highest points are Ben Lawers, near Loch Tay, 4004 feet above the sea; Ben More, 3835; Ben Gloc, 3671; Schiehallion, 3547; Ben Ledi, 2875; and Ben Venue, 2393, near Loch Katrine and the Trossachs. Where the Highlands sink down into the Lowlands the scenery is generally of the most striking character. Benelough, in the Ochils, is 2358 feet; Birnam Hill and Dunsinane, in the Sidlaw range, are 1580 and 1040 feet high respectively. The various mountainous districts are intersected by long, winding, narrow vales or "glens," through which the streams flow, and by "straths" or wider valleys. Strathallan, in the south-west part of the county, separates the Ochil Hills from the mountains of the Western Highlands; Strathearn extends across the centre of the county from west to east; Strathitay, and lower down, Strathmore (which extends into Forfar, or rather through it), from the valley of the Tay. Strathitay communicates with a glen in the Grampian Hills, by the famous Pass of Killiecrankie, at an altitude of 470 feet. Here the river Garry flows for about 2 miles through a narrow, rocky, and thickly-wooded ravine of great depth, along the side of which the road has been cut, overhanging a terrific precipice. The pass is traversed by the Highland Railway, and at its north-west extremity the battle was fought in 1689 in which Claverhouse, Viscount Dundee, was killed.

The extreme south-west of the county belongs to the basin of the Forth, and contains the striking defile of the Trossachs, with the lovely expanses of Lochs Katrine, Achray, and Venachar. Wholly different features appear in the extreme north-west, the district of the Moor of Rannoch, an elevated table land extending about 20 miles in every direction. It feeds some wild animals, is visited by few birds, has neither tree nor shrub, except a few firs on the margin of Loch Rannoch, but is largely overgrown with moss and rushes, interspersed with blocks of granite. A few roads cross the wilderness, with houses at intervals for the accommodation of drovers, strongly built to withstand the rough winter storms.

The most important river in the county is the Tay, which drains nearly the whole of it. Rising in a small loch or lake near the extreme west, on the border of Argyre, it flows east and east by north 20 miles, through Loch Dochart into Loch Tay, a narrow lake about 15 miles long, embosomed in mountains, and having Ben Lawers near its north-west shore. From the north-east end of the loch it proceeds to Perth, below which it extends into an estuary from 1 to 3 miles in width, called the Frith of Tay, and joins the North Sea, its total course being about 120 miles. It is the largest river in Scotland, and carries more water to the sea than any other in Great Britain. Dundee and Forfar are on the north, and Newburgh on the south of the estuary. Extensive sandbanks impede the entrance, but ships of 1000 tons come up to the latter place, 20 miles from the sea; and vessels drawing about 9 feet can discharge at Perth. The country through which the Tay winds is one of picturesque beauty; its affluents are the Garry, Tilt, Tummel, Airdle, Isla, Lyon, Almond, Earn, and many smaller streams. The southern part of the county is watered by the rivers Teith, Allan, and Devon.

The lakes of Perthshire are numerous and interesting, the largest being Lochs Earn, Tay, Tummel, Katrine, Rannoch, and Erchie. Their aggregate area is estimated at 32,000 acres. From Loch Katrine Glasgow is supplied plentifully with pure water. There are mineral springs at Piteathley. In the rivers are several falls. Those of the Bruar and the Tummel are very picturesque; and the falls and rapids of the Devon, called the Devil's Mill, the Rumbling Bridge, and the Cauldron Linn, are worth a visit.

Geology and Agriculture.—Granite is found underlying

the pent of the extensive waste of Rannoch Moor in the western part of the county; but the predominant rock in this district is mica-slate, skirted by clay and chlorideslate, both of which pass insensibly into mica. Basaltic rocks may be traced in a north-east direction, sometimes capping heights of sandstone, sometimes forming entire hills of considerable magnitude, and at others irregularly interstratified with sandstone beds. The Ochil Hills, in the south-east part of the county, consist chiefly of porphyry and amygdaloid; and the Hill of Kinoull, near Perth, is an amygdaloid containing numerous nodules of agate and cornelian. Some coal is raised in the south-east; limestone, sandstone, marble, and slate are abundant, and lead is found in some places. The soil in the mountain districts is mostly light, and chiefly adapted for pasturage, the occupation of sheep and cattle breeding being extensively followed. There is much good land along the banks of the Earn, Teith, and other rivers; but the best is a tract of deep fertile clay in the Carse of Gowrie, between the Tay and the Sidlaw Hills. Here the ground is very productive; tillage farms vary from 50 to 500 acres; farm buildings are good; and an improved system of agriculture is successfully followed, producing crops of wheat, beans, potatoes, and turnips, besides apples and pears in sheltered spots. Much of the land is, however, unfit for the plough. According to the official agricultural statistics there were only 345,000 acres—or little more than a fifth of the entire area—under cultivation in 1885. Corn was grown on 100,000 acres, green crops on 50,000, clover and other grasses on 100,000, and 90,000 were permanent pasture. The number of cattle in the county at the same time was 80,000, and of sheep 700,000. There are some large entailed estates; but property, on the whole, is well divided. Various breeds of stock are kept, but black cattle are the most general. The sheep are chiefly Tweeddale and Cheviots on the Highland farms, but Southdowns and other hardy English breeds have been introduced. The salmon fisheries of the Tay are valuable. Besides the natural woods, a large part of the county has within the last century been planted with larch, &c. Athole Deer Forest comprises 100,000 acres, and contains about 6000 head of deer.

Manufactures, &c.—The manufactures of the county are yearly extending, chiefly at Perth, Blairgowrie, and Cupar-Angus. Linen, cotton, and woollen stuffs, silks, leather, and paper, are made, and there are some breweries and distilleries. Coal, lead, and copper are found in small quantities; limestone is extensively quarried, and there are also some quarries of marble, freestone, and slate. Good roads have been made in different parts of the county; and the Caledonian, North Eastern, Scottish Central, and Highland railways afford communication with all parts of the county.

Divisions and Towns.—Perth is divided into two districts, each under a sheriff-substitute; and is subdivided into ten smaller districts, each under the jurisdiction of a justice of the peace court. Under the Redistribution of Seats Act of 1885 the county returns two members to the House of Commons—one for the Western and the other for the Eastern divisions. One member is also returned for the city of Perth.

History and Antiquities.—This county was the scene of hostilities in the sixth and seventh campaigns of Agricola (A.D. 83, 84); and Septimius Severus must have crossed it in his war against the Caledonians (206-7).

At the downfall of the Roman Empire Perth was occupied by the Picts, and it afterwards came into the hands of the Scots. In the latter part of the tenth century the Danes arrived at the mouth of the Esk with a large fleet, and landing marched to the Tay. They were entirely routed by the Scottish king, Kenneth III., at Lonearty, near Perth, probably in 990. The importance of the chief city, and

its rank as capital of the kingdom, made this shire the scene of many contests. The town itself was repeatedly taken and retaken in the course of the struggles of the civil war of Charles I. and the rebellions of 1715 and 1745.

Perthshire was the seat of the Horestii, in Vespasiana. A Roman road, following the direction of Strathearn and the Scottish Central Railway, went from Kier, on the Forth, to Ardoch (the ancient *Lindum*), to *Ad Taram*, near Perth, and Braemar. The antiquities of the county comprise forts and camps at Fortingall, Callander, Dalginross, and Ardoch, a round tower at Abernethy, the capital of the Pietish kingdom, including lowland Perth; the remains of Dunblane and Dunkeld cathedrals; Cupar-Angus abbey, with some other scanty ecclesiastical ruins; the

remains of ancient castles at Moulin, Doune, Kintcardine, Kinclaven, Ruthven, and Drummond, with some hill forts, cairns, and Druidical stones. Blair-Athole Castle has been modernized, and is the seat of the Duke of Athole.

PERTH, the capital of the above county, is situated about 41 miles N.N.W. from Edinburgh, 62 from Glasgow, and 452 from London. It is a city, royal and parliamentary burgh, and port, situated on the right bank of the Tay, in a fertile and beautiful spot, between two spacious parks or meadows, called the North and South Inches, near the Moncrieff and Kinnoul Hills. Races take place on the North Inch, where a statue of the Prince Consort was erected in 1864. Perth is often styled the "Fair City," on account of the extreme beauty of the landscape by which it is surrounded. It succeeded the Roman *Perthia*,



Perth, from above the Bridge.

which was an important station at the meeting of three great highways, and it has some remains, which have been attributed to Agricola, with various ruins of ecclesiastical buildings. For some time it was the metropolis of Scotland, being frequently resorted to by the Scottish kings, and was the scene of many historical events, among which the assassination of James I., at the Blackfriars Monastery, is perhaps the most striking. It had a large Cistercian house, in which many parliaments and councils were held, down to 1437; and was surrounded by walls and fortifications, all traces of which, with the citadel built by Cromwell, have disappeared. The modern town consists of High Street, South Street, George and John Streets, and other main streets, occupying a space of about three-quarters of a mile by half a mile, the level of which has been gradually raised by inundations of the river. From near the race-course on the North Inch or "Island" (the site of the celebrated battle between Claus Chatan and Kay

in the reign of Robert III.), a ten-arch Bridge, 900 feet long, built in 1772 by Smeaton, crosses to Bridgeend; and a viaduct on the railway from Dundee from the Caledonian station crosses the stream near the South Inch and its gardens. The most interesting building is St. John the Baptist's old church, supposed to have been originally erected in the fifth century. It is 207 feet long, has a square tower (possibly part of the original edifice) 155 feet high, and is divided into three distinct places of worship. There are also four other Established churches, St. Ninian's Cathedral, and six Free churches, four U.P. churches, and two Episcopal and two Roman Catholic churches. The city is the seat of a presbytery, in the Synod of Perth and Stirling, and of the bishopric of St. Andrews, Dunblane, and Dunkeld. About 9 miles from it, in Glen Almond, is Trinity College, an episcopal seminary, consisting of a handsome quadrangular group of buildings in the Gothic collegiate style. The County Buildings, in the Grecian

style, on the site of Gowrie House (the scene of the Gowrie plot of 1600), comprise a justiciary (or assize) hall, county hall, &c. The other buildings in the town are the Municipal Buildings and Public Hall, a government convict prison, or general prison of Scotland, formerly a depot for prisoners of war; lunatic asylum, custom-house, infirmary, baths, large cavalry and infantry barracks, freemasons' hall, handsome public library and museum, in Provost Marshall's building, academy or high school, grammar and several other endowed schools, James IV.'s Hospital, rebuilt 1750, Craigie Reformatory, &c. There is a cemetery on the site of Greyfriars, and another at Weleshill, west of the city. The streets are wide, and the town is generally well built. The water supply, obtained from the Tay, is filtered, raised by steam into two elevated reservoirs, and thence distributed over the city, rising to the upper storeys of the highest houses. At the bottom of High Street is a statue of Sir Walter Scott, accompanied by his favourite dog. Several Gaelic and other benevolent societies have been established. The Perth Literary and Antiquarian Society has a museum. Besides the Central Bank of Scotland, in the Grecian style of architecture, completed in 1848, there are numerous branch banks. The principal manufactures are of coloured cottons, prints, ginghams, winceys, shawls, and shoes; there are also bleaching-works, flax-spinning mills, corn mills, breweries, distilleries, rope-walks, iron foundries, tanneries, and dye-works in the town and neighbourhood. The glove trade, which was once considerable, has entirely died out. Shipbuilding is almost extinct, but the salmon fisheries in the Tay are of great and increasing value. There are ponds for the artificial propagation of fish at Stormontfield, on the river, 5 miles above the town. A canal, supposed to be of Roman construction, brings water from the Almond, 4 miles distant, which supplies the bleachfields of Huntintower, Ruthven, and Tulloch, and the flour mills of Perth; and the Tay is navigable to Perth for vessels of 250 tons burden. Steamers ply to Dundee. There is also a general terminus of the Caledonian, North British, North Eastern, and Highland railways, in this city. The exports are chiefly manufactured goods, corn, potatoes, salmon, and sheep.

The burgh of Perth was first chartered by David I.; it is at present governed by a lord provost, four bailies, and nineteen councillors. It is the seat of justiciary, quarter sessions, sheriff, small-debt, and commissary courts, the head of an excise collection, and the headquarters of the county militia. The population of the parliamentary burgh in 1881 was 28,949.

Kinfauns Castle, Dupplin Castle, and Scone Palace, the latter situated on the site of a former residence of the Scottish kings, are within a few miles of Perth. From the Wicks of Raigie, near Moncrieff Hill, there is a magnificent prospect, bounded on the north by the Grampians, 60 miles distant.

PERTH, an episcopal city of Australia, the capital of Western Australia, pleasantly and picturesquely situated on the Swan River, about 12 miles above Fremantle. The city is well laid out, and its chief buildings are the city hall, adjoining which is the legislative chambers, the governor's palace, the government buildings, the Protestant and Roman Catholic cathedrals, and Wesleyan, Congregational, and Presbyterian churches. There are also pensioners' barracks, an hospital, and mechanics' and workmen's institutes. The main street is 2 miles long and planted with trees. The population in 1881 was 6000. Perth was constituted a municipality in 1856 and a city in 1880.

PERTINAX, HELVIUS, Roman Emperor for the first three months of 193 A.D., was the son of a Ligurian charcoal burner, who became a schoolmaster, and afterwards rose to high military command under Marcus Aurelius. When Commodus was murdered, Pertinax, then prefect of the city, was elected his successor. He was very unwilling

to assume the purple, but the great respect his long and blameless career had earned made the murderers of Commodus anxious to secure his consent, as behind such a character they might shelter their own crime. Pertinax was sixty-six years old, accustomed to order, simplicity, and discipline all his life. He began to treat the empire as he used to do his armies, trusting to meet with the same affectionate response. The banquets of Commodus, the irregularities of the court, the heavy taxation all disappeared, and a golden era seemed to have begun. Unhappily the Prætorian Guards did not join in the general satisfaction. They dreaded the strict discipline of their new lord, and missed the lavish gifts with which their favour had been bought. Two or three hundred of them therefore suddenly marched upon the palace to make away with the emperor, their comrades on guard opened the gates to them, and Pertinax, apprised of their approach, himself calmly advanced to meet them and received his deathblow with unaltered dignity (28th March, 193). The troops then sold the empire by public auction to Didius Julianus, a lawyer.

PERTURBATIONS, in astronomy, are the effects of the attraction of the heavenly bodies in our system upon one another, so that their periodic motions are altered in time and in direction from what they would be if no such perturbing influences existed. The perturbations are of course mutual. Jupiter sways the earth from her due course only to exactly the same extent as the earth sways Jupiter, due regard being had to the weight of each.

PERU is a country in South America, situated between 3° 21' and 19° 10' S. lat., and between 68° and 81° 20' W. lon. On the W. it is washed by the Pacific; on the S. and S.E. it borders on Bolivia; on the E. it is bounded by Brazil; and on the N. by Ecuador. The total area is estimated at 500,000 square miles.

Surface, Soil, and Productions.—As Peru comprehends the whole of the mountain masses of the Andes which lie between 15° and 5° S. lat., together with the countries on both declivities of the chain, it is naturally divided into three different regions. The country between the chain and the Pacific is called Las Valles, and that included between the higher ranges of the Andes, La Montana. The region on the eastern declivity of the Andes and the plains contiguous to it may be called the Eastern Region.

1. *Las Valles*, between the steep ascent of the Andes and the Pacific, varies in width from 15 to 50 miles, and may be considered as the western base of the mountains. It has a great elevation above the level of the sea where it lies contiguous to the range, on an average between 8000 and 10,000 feet, and from this it slopes towards the coast with a very irregular surface, which is furrowed by a number of depressions running from the Andes to the sea with a rapid slope, traversed by rivers, many of which are dry during nine months in the year, and only a few preserve a running stream all the year round. As it never rains in the lower portion of this region, vegetation and agriculture do not extend beyond the reach of irrigation, and where, as in many places, copious dews are deposited. The narrow strips along the rivers are cultivated in proportion to the supply of water, while the uplands between the valleys are deserts. Some of them are 90 miles in width, and are perfectly trackless, being covered with a fine, shifting, yellow sand, which is often carried about by the wind in pillars of from 80 to 100 feet in height. The temperature is modified by the vicinity of the sea, and is seldom excessively high. The alternation of land and sea breezes renders the climate salubrious. The chief endemic disease is goitre, but cretinism is unknown. Indian corn, rice, wheat, barley, olives, and many kinds of fruit are grown, the different elevations of the valleys presenting sufficient diversities of climate. The soil is not very fertile, and requires a good deal of guano and similar animal deposits to manure it.

II. The *Mountain Region*, or *Motana*, possesses sources of inexhaustible wealth in the richness of its vegetation, the colossal size and peculiar character of its trees, its balsamic and medicinal products, and its fruits and substances, exotic to all other countries. It comprehends the central portion of the Andes, consisting of two parallel ranges, extending from about S.S.E. to N.N.W. The western is a continuous chain, without any break, and generally rises to 14,000 or 15,000 feet above the sea level. Among its summits are those of Nevado de Chuguibamba (22,000 feet), Arequipa (volcanic, 17,200 feet), and La Viuda (15,968 feet). The eastern chain runs, for the most part, parallel to the western, at the distance of about 100 miles. It is composed of an almost uninterrupted series of snowy peaks, which terminate with the Nevado de Salcantay (13° 10' S. lat.) The two unite at the elevated table-land of Pasco, which is situated between 11° 10' and 10° 30' S. lat. In the northern portion of the eastern chain there are a few snowy peaks, as the Paramo de Caracalla (near 7° S. lat.), and the Paramo de Piscocoma (south of 5° S. lat.).

The country included by these two ranges contains four regions, which differ materially in climate and productions. The table-land of Cuzco is about 150 miles long by 100 wide; it is so elevated that the town of Cuzco, in 13° 31' S. lat., is 11,380 feet above the sea level. The climate is admirable. The soil is moderately fertile, and is watered by many short but rapid rivers. The table-land of Pasco is the highest of those inclosed within the Andes, the level parts being 14,000 feet above the sea. The great elevation gives it so cold a climate that nothing is cultivated; the mineral deposits are the only sources of its wealth. The vale of the Rio Jauja extends from the table-land of Pasco on the north, about 100 miles southwards, between both ranges of the Andes, and in the widest part is about 30 miles across. It is less elevated than the table-land, and is more fertile and populous. The Vale of the Rio Marañon extends from 10° to 5° S. lat. The southern part is very narrow, the river running in a valley so contracted that it is merely a wide ravine. This is by far the hottest portion of the mountain region, and the vegetation in the lower parts does not differ from that of other tropical countries.

On the west side of the Peruvian Andes the vegetable productions observe a gradation in character according to the elevation. There are several narrow and rugged passes or mountain roads across the mountains, at elevations varying from 12,000 to 16,000 feet above the sea-level, which is nearly the limit of perpetual snow. Occasionally from these narrow passes gaping and apparently bottomless precipices slide perpendicularly downward from the very foot of the traveller; and the prospect is rendered still more hideous by the distant roar of a torrent, hidden by mists at the bottom of the ravine. Occasionally, also, the mountain route leads over abysses 500 feet in depth, across which, by way of a bridge, a few poles are thrown, which roll about in an uncomfortable manner under the feet. In traversing these dangerous passes, which line the huge rocks like aerial threads, the traveller often meets with scenery of the most beautiful description. The clefts and sides of the hills, even at altitudes which might be called Alpine, are clothed with wild flowers, many of which, now long cultivated in Britain, have become highly prized as garden plants. Verbenas, blue and scarlet salvias, fuchsias, calceolarias, and the fragrant heliotrope, add a sense of beauty to that of power which the stupendous scenery imparts.

III. The *Eastern Region* comprehends the eastern declivity of the Andes and the adjacent plains, as far as they belong to Peru. On the slopes of the mountains rain falls copiously; and the soil in the valleys of the upland region is highly fertile, the various grains of Europe being successfully cultivated. The domestic animals generally bred

in this district are the same as in Great Britain, and there are extensive pastures, where sheep introduced by Europeans have been acclimatized, and multiply with amazing fecundity. The vast plains east of the mountains are fertile, well-watered, and often covered with dense forests, containing valuable timber. They are also rich in plants and vegetables, among which are sour cane, which, when properly prepared, cures the intermittent fever; coffee equal to that of Carabaya, which is perhaps the best in the world; cotton, tobacco, barbasco, the root of which is used by the savages for fishing, because when thrown into the water it operates on the fish as a narcotic; suni, the leaves of which give a blue dye; huito or jagua, a high and thin shrub, of the trunk of which spoons are made, and the fruit dyes the hair a strong black; blanchama, the bark of which is so flexible that after cutting and pounding it stretches like cloth; quimba, a tree 40 feet high, its fruit not unlike cotton; and sapaja, a tree like a palm, the leaves of which from their hardness serve for combs, being opaque like tortoise-shell. Tobacco is cultivated the whole length of the Huallaga, and yields magnificent crops, part of which is exported to Brazil. Tropical productions are grown in the few cultivated tracts, and Peruvian bark [see *INCUCONA*], sarsaparilla, copaiba, vanilla, and other drugs, are abundant. In the forests are found great numbers of wild independent Indians. One cause which prevents the Peruvians from fully availing themselves of the productiveness of these rich valleys is the prevalence in them of intermittent fevers. Cholera is very common.

Peru is subject to frequent and fearful earthquakes. The capital, Lima, suffered severely from them in 1746 and 1828. Probably, however, the most terrible which ever visited the country was that of 1868, when several towns were destroyed and many thousand persons lost their lives.

Rivers.—The rivers which descend from the western declivity of the Andes and fall into the Pacific are shallow, have a short course, and flow with great rapidity. With the exception of the Piura, they cannot be navigated even by the smallest canoes.

All the important streams of Peru originate within the mountain region, and all the waters which collect in it are united in three large rivers, the Tuguragua or Upper Marañon, the Huallaga, and the Ucayali. These three may be considered as the chief branches of the Amazon. The Upper Marañon, which is commonly considered the principal, issues from the Lake of Lauricocha, on the table-land of Pasco. It is joined by the Huallaga near 5° S. lat. and 76° W. lon., and afterwards by the Ucayali, which brings to the Amazon the drainage of the mountain region situated between 11° and 15° S. lat. This large river is formed by the junction of the rivers Urubamba and Tambo, which takes place near 9° S. lat. [See *AMAZON*.] The Amazon and the Ucayali are navigable for a great distance within the confines of Peru.

Productions.—The trees and plants which are the chief objects of cultivation in Peru have been already enumerated. The forests supply, besides fine timber, copaiba, caoutchouc, dye-woods, medicinal barks, resins and gums, indigo, and a number of other highly useful products.

In the extensive province of Loreto, in the north of the country, the plantain serves instead of bread, of which there is none. The sugar-cane grows here in the greatest luxuriance, and it is sufficient to plant it once to have constant crops from the roots. Coca yields six times a year. A Peruvian will endure the severest labour while chewing the leaves of this extraordinary plant, and will accompany a horse or mule for days together up hill and down, and through the deepest sand, with scarcely any other refreshment. Tea, or a decoction of the leaves, is a most wholesome, refreshing, and agreeable beverage. Cotton thrives almost spontaneously in the neighbourhood of the houses, and serves the inhabitants, gray shirting being an article

of exchange among them. Coffee grows in extraordinary abundance.

The domestic animals of this country, introduced from Europe, include horses, mules, cattle, and sheep, but only the latter are at all numerous. The llama, alpaca, guanaco, and vicuña, are natives of Peru. The former, common to the other Andean countries, and entirely domesticated, is invaluable to the Indian population, supplying them with food and clothing. It is in use also as a beast of burden, and was the only animal employed for that purpose in America prior to the introduction of European quadrupeds. The alpaca, also domesticated, is somewhat smaller and yields a finer fleece. The Peruvian government formerly prohibited the export of these animals under heavy penalties. But, following a route through Bolivia and Chili, a herd was safely exported to Australia, and the restriction was then relaxed. The vicuña, altogether wild, is handsomer than either the llama or the alpaca, and furnishes a finer wool. It inhabits the heights of the Andes, on the verge of perpetual snow. The guanaco, also wild, thrives at a lower level, and ranges southward to the Strait of Magellan. Nearly all the other wild animals peculiar to South America are found here. Whales, seals, and fish are abundant along the coast or in the rivers. Altogether the country is extremely rich in natural resources, which only require to be developed; the mines are one of the principal sources of its wealth. Throughout all its history the name of Peru has been associated with undoubted mineral wealth, the accounts of which have been almost fabulous. Among the mines at present in operation, those of silver at Pisco are the richest. The Andes contain veins of gold, silver, copper, bismuth, lead, tin, and nitrate of soda. There is a celebrated mine of quicksilver at Huancabellia. Coal, iron, sulphur, saltpetre, and salt, may also be included among the mineral products. The source of wealth, however, which has above everything else enriched Peru, has been its GUANO beds. The revenue from these for a time amply sufficed for the internal administration of the country, and enabled it to obtain loans on comparatively easy terms for the construction of works of public utility. The value of its annual export averaged for many years about £5,500,000, but since 1876 this sum has gradually decreased, and in 1880 but little of the immense deposits remained. Another important fertilizer is now largely exported—viz., nitrate of soda. Unlike guano, however, this cannot be exported in its natural state, but requires some elaborate process of manipulation. The province of Tarma, however, in which the chief of these deposits occur, has been seized by Chili.

Inhabitants.—According to a rough enumeration made in 1876, the population of Peru amounts to 2,675,000, the greater number of them descendants of Spaniards, mixed with Indians. With a few exceptions, every Peruvian enjoys the rights of citizenship. The Peruvian Indians inhabit Las Valles and La Montana, to the exclusion of all other native tribes. They speak a language which is generally called that of the Incas. Prior to the invasion of South America by the Spaniards, they had attained a considerable degree of civilization, and had constructed roads and many extensive buildings, of which vestiges yet remain. The oppressions to which they have been subject have probably sunk them to a lower point in the scale of civilization than they formerly occupied. The mildness of the climate and the fertility of the soil having, on the one hand, diminished their wants, and on the other enabled them to supply those they feel with comparatively little exertion, have also removed or greatly weakened the most powerful incentives to labour and invention. The dwellings of the majority of Peruvians are dirty, and destitute of every convenience or comfort; their dress is very poor, and their food scanty. Their religion is mingled with the grossest superstitions, encouraged by an ignorant class

of priests. The Incas, previous to the coming of the Spaniards, had themselves conquered and displaced a race, whom they called *Yuncas*, and whose remains show that they had attained a very high condition of civilization.

When Peru was a colony of Spain, African slaves were imported thither as into most Spanish colonies. All the blacks were made free in 1855, and in order to supply their places as agricultural labourers Chinese coolies were imported. There are now several thousands of them in the country. They maintain their nationality in every possible way, and as soon as their "apprenticeship" is expired they generally contrive to repair to the towns, and set up as vendors of vegetables and other necessities of life, and often realize considerable profits. The coolie trade, however, under its best aspect, can hardly be looked upon as much other than a kind of white slave trade, legalized by laws and regulations not always conscientiously complied with.

Constitution, Government, &c.—The form of government is republican, all power being held to emanate from the people. The constitution is modelled on that of the United States, the legislative power being vested in a Senate and a House of Representatives; the former composed of deputies of the provinces—two for each—and the latter of representatives elected by the electoral colleges of provinces and parishes. The parochial electoral colleges consist of all the citizens resident in a parish, for every 200 of whom an elector is nominated; and in every village with an amount of population entitling it to name an elector, a municipal body is established, subject to the approbation of the departmental *juntas*. The electoral colleges of provinces are composed of the parochial delegates, who elect deputies to Congress in the proportion of one for every 20,000 inhabitants. The provinces, however, in which the whole population does not come up to 10,000, may nevertheless send a deputy.

The annual revenue and expenditure of Peru in prosperous times were each about £12,000,000, the former derived mainly from the sale of guano, miscellaneous receipts, and customs. The public debt is divided into an internal and external. The internal liabilities are estimated at £1,000,000, exclusive of a floating debt of an unknown amount, greatly increased by large issues of paper money, made in 1879 and 1880 to carry on a war against Chili. The total of these issues has been estimated at £7,000,000. The foreign debt is made up of three loans contracted in England from 1869 to 1872:—

Foreign.	Outstanding Principal.
Pisco-Yca Railway 5 per cent. loan of 1869,	£264,760
Railway 6 per cent. loan of 1870,	11,141,500
" 5 per cent. loan of 1872,	21,546,740
Total,	£32,953,000

It is impossible, however, to afford any accurate idea of the financial position since 1879. The war with Chili brought the country to complete financial ruin.

The religion of Peru is the Roman Catholic; no other is tolerated. The religious ceremonies are performed with great pomp and splendour. Each of the departments is a diocese or bishopric. The clergy are said to be careless of their duties and lax in their morals. Education is very little diffused among the lower classes, although some improvements have been made.

Trade and Commerce.—The prospects of Peru very much improved after the discovery of the guano, of which she exported enormous quantities, procured chiefly at the Chincha Islands, close to the Bay of Pisco. In spite of chronic political squabbles and internal revolutions, great efforts were made to develop its material resources, by the construction of roads and railways, and by rendering the

ports safer and more accessible. The nature of the country offers vast engineering difficulties to railway construction, but many of these have been successfully conquered; and Peru possessed in 1881 eleven lines of state railway, and an equal number belonging to private companies, of the united length of 2030 miles. Of these, however, only 1500 miles were so fully complete as to be open and working. The most remarkable of the lines are—that from Callao and Lima to Oroya, a triumph of engineering, which crosses the Andes at a height of 15,000 feet above the level of the sea; that from Cuzco to Juliaca and Puno, 230 miles in length, on the lofty plateau of the Andes, at a mean elevation of 14,000 feet; and that from Mejia to Arequipa and Puno, 339 miles in length, establishing a communication between the Pacific Ocean and Lake Titicaca, 13,902 feet above the level of the sea. The main design of these railways is to render accessible the wonderful mineral wealth of the country, including its mines of nitrate of soda. The climate, soil, and vegetation offer a large field for European settlers and peasantry, especially to farm labourers and miners, the necessities of life being in ordinary times abundant and reasonable in price, and productive land in immense expanse being easily obtainable.

The chief exports are nitrate of soda, guano, cotton, wool (alpaca and sheep's), copper, and bark. The export of guano is now about 30,000 tons per annum.

The trade between the United Kingdom and Peru in recent years has been as follows:—

	Imports from Peru.	Exports to Peru.
1883,	£2,250,176	£731,577
1884,	2,082,831	1,080,854
1885,	1,875,206	704,288

Equal in importance to guano, until the war with Chili, as an article of export, was nitre, which, like guano, is also a government monopoly. The quantity sent is now about 1,500,000 tons every year. Unrefined sugar, value £500,000, and sheep and alpaca wool, worth £150,000 annually, are likewise imported into the United Kingdom from Peru, which also exports Peruvian and other barks, chinchilla furs, &c. Cotton and woollen manufactures, iron, coal, machinery, leather manufactures, and opium, are the principal British exports to Peru. The maritime trade is chiefly with the ports on the west side of America, but that with Europe is also considerable. The principal port of the republic is CALLAO. The high and unbroken coast of the Pacific is a disadvantage as regards commerce. In most parts vessels cannot reach the shore; and as the surf occasioned by the ocean swell renders landing by boats always dangerous, and often impracticable, goods and passengers are conveyed to and from the land on a sort of raft called *balsas*, which is made buoyant by means of inflated seal-skins.

Ancient Civilization, Religion, and History.—When the Spaniards first visited Peru in the beginning of the sixteenth century, they found the country under a wonderfully well-regulated government, and inhabited by a people who had made great progress in the arts of civilization. Unhappily for our knowledge of their early history they had no alphabet, nor had they learned to use hieroglyphics, so that the annals of the nation, with its traditions and legends, were only transmitted orally by the *amautas* or wise men. The only substantive record of national transactions consisted of the Quipus or Quipos, or fringes, the threads of which were variously knotted according to what they were intended to represent. A may be readily imagined this rude method formed a very imperfect record, and the wise men frequently differed among themselves as to the meaning of the knots preserved, and devised several methods for their interpretation. Moreover, the Europeans who first landed in Peru and

their immediate successors were hardly the people to make an earnest study of the mystery of Quipu reading, so that it soon became a forgotten art. Hence all that is known concerning the ancient history of Peru is that which was collected by the Spaniards from the traditions of the people, and what may be deduced from the then existing stage of civilization and the architectural remains still in existence. From these various sources we learn that the government which prevailed at the beginning of the sixteenth century represented the results of some 600 years' rule of the family of the Incas, a race of priest-kings who reigned as the children of the Sun, the great deity of the country. This family appears to have sprung from a priesthood which arose on the shores of the sacred Lake of Titicaca, and which at a certain period became the ruling power at Cuzco. From thence their power became extended over the smaller states around, and by means of conquest and diplomacy they increased their influence and dominions, until an extent of territory, nearly 2500 miles in length, with a breadth varying from about 250 to nearly 500 miles was included under one rule. During the progress of their conquests the Incas incorporated several races whose civilization was much older than their own, and whose religions they were compelled to recognize and admit to a subordinate place in the national system. The Incas appear to have possessed wonderful sagacity as rulers, and to have practised every device which has been tried elsewhere for attaching conquered peoples to themselves or rendering them harmless, and in the end they so completely succeeded in identifying the interests of their own family with those of religion, of politics, and civilization, that it was no longer possible to distinguish them one from another. Under their rule the whole of the land of the empire was divided into three parts. The first was devoted to the Sun, that is to say, to the priests who officiated in his numerous temples; the second belonged to the reigning Inca; and the third, which belonged to the people, was divided out every year in lots apportioned to the needs of each family, the portions assigned to the nobles being of a magnitude suited to their superior dignity. It does not appear that this annual division implied redistribution, and it is probable that as a rule each tenant was confirmed in his occupation. In the cultivation of the land the sacred territory allotted to the Sun was first attended to, then the portions belonging to the people were tilled, the lands of the Inca being reserved to the last. No one was allowed to be idle, not even old men or children, the only exemption being that of infants under five years of age; and though the Peruvians were unacquainted with money, they seem to have fairly solved the problems involved in the exchange and distribution of the products of labour. Owing to the richness of the soil and the variety of its products food was abundant, and though all were required to labour, the work was light, and it was diversified with frequent holidays and festivals. The wealth and leisure of the people enabled them to execute enormous public works, and although under the blighting and devastating rule of the Spaniards these have fallen into ruin, the remains still excite the amazement of architects and engineers accustomed to all the resources of modern Europe. The soil was cultivated to a wonderful degree of perfection, even the sloping sides of the hills being cut into terraces, which were converted into gardens and fields. The rainless stretches of the coast, now mere sandy deserts, were rendered productive by one of the most stupendous systems of irrigation that the world has ever seen. The aqueducts constructed to bring the water from the mountains, some of them 500 miles long, were tunnelled through mountains, and carried across rivers and marshes, and they were preserved throughout with scrupulous care. Splendid roads stretched from Cuzco towards the four quarters of heaven, and Humboldt still traced some of them paved with black

porphyry, or, in other cases, macadamized, ravines being bridged and hills fearlessly pierced in their course. Architecture was in a well-developed stage. The Incas' palaces, of which there was one at least in every city of importance, were imposing buildings, solidly built, provided with spacious halls, inner courts, hot and cold baths, abundant sculptures, and gold and silver ornaments in lavish profusion. The temples—both those erected by the Incas and those of the peoples subjugated by them—were of colossal dimensions, containing gigantic stone statues, gates cut out of monoliths, large sun pillars, and numerous altars. The great Temple of the Sun at Cuzco, which consisted of a vast central edifice, flanked with a number of adjacent buildings, was known as the "place of gold," from the enormous quantity of gold lavished upon its interior. The doors opened to the east, and on the western wall was placed an immense golden disc to represent the sun, which caught the first beams of the morning and reflected them back upon walls, cornices, rafters, and images all plated with the precious metal, until the whole temple shone with the radiance. In the provinces the Incas reared a number of temples of the sun on the model of that at Cuzco, but on a smaller scale. The roofs both of temples and palaces were merely thatched with straw, but the walls were built of granite, porphyry, and other varieties of stone. The style was that known as Cyclopean, the stones of the walls being huge and irregular in size, but their surfaces were fitted so closely that even at this day it is often impossible to insert a knife or a needle between the seams. In addition to the worship of the sun, the moon, and the stars, the people worshipped two great deities, named *Viracocha* and *Pachacamac*. The former deity appears to represent the power of water, and his worship was older than that of the sun-worship of the Incas. Pachacamac, on the other hand, was a god of fire, and his colossal temple in the valley of Lurin, south of Lima, was left standing by the Incas when they conquered the country, though it is now in ruins. There were numerous other deities of minor rank, who received adoration in various parts of the empire, while the lower orders of the people were much given to sorcery and fetishism. The highest positions in the priesthood, as well as in the army and administration, were reserved for members of the Inca family; but in the provinces the priests of the local deities were drawn from other sources. In addition to the priests it was the custom for women to be devoted to the service of the Sun, and nunneries for their reception were established in all the chief cities of the empire. These virgins took the vow of chastity, the penalty of death being sternly enforced in the event of its violation. As with the vestal virgins of Rome, the offender was buried alive; but in Peru the accomplice was also strangled, and the whole family of the nun from first to last were put to death. The vow of chastity was relaxed, however, at the pleasure of the Inca, who, as the child of the Sun, was allowed to choose certain of them for his harem, and also to bestow some of them upon the higher nobility of the Inca family. It was the duty of the nuns to prepare the sacred bread and the sacred drinks used in the temples, to weave tapestries for the temples and palaces, to make robes for the members of the imperial family, and to watch and feed the sacred fire.

The offerings presented to the gods consisted of flowers, incense, vegetables, fruit, maize, prepared drinks, and sacrifices of blood. Small birds, black dogs, and llamas were frequently offered, and the priests practised divination by means of the entrails of the slaughtered victims. Human sacrifices were occasionally offered; but these appear to have been minimized by the Incas, and the Spaniards found the worship of the Peruvians gentle and humane when compared with the hideous cruelties practised in Mexico. [See MEXICO.] Like the Hindus, the Peruvians approved the practice of wives putting them-

selves to death on the death of their husbands, but they do not appear to have made it compulsory. They believed in a life after death, in a heaven for the descendants of the Incas and the distinguished members of the Inca family, and in an underworld of a shadowy character for others. Death was not regarded with much terror, and it is asserted that when the Inca Huayna Capac died, a thousand members of his household incurred a voluntary death that they might go with him and serve him.

On the whole the Peruvians appear to have been a contented prosperous people, and to have enjoyed many of the blessings of civilization. Their theocratic government, however, was fatal to individuality, and when Pizarro seized the person of the Inca, the whole social fabric fell into ruins. An account of the adventures and excesses of the Spanish invaders will be found under ALMAGRO and PIZARRO. After the extinction of the Pizarro family Peru became a viceroyalty of Spain. In 1718 the province of Quito was separated from Peru, and in 1788 considerable territories on the south were detached and formed into the government of Buenos Ayres. When the Spanish colonies began to revolt against the tyranny of the mother-country after the year 1810, Peru remained quiet; and though some of the neighbouring provinces soon expelled the Spanish armies, the Spaniards remained here in undisturbed possession until 1820. The contest between the Republicans and Spain lasted from 1820 till 1821, when Spanish dominion in Peru was put an end to by the battle of Ayacucho. Since then the government has been nominally republican, but practically the country has been governed by a series of military despots. The war with Chili, which was entered upon in 1879, inflicted great misery and disaster upon Peru, and resulted in the loss of the province of Tarapaca. The Chilians also occupy the departments of Tacna and Arica for ten years, after which a popular vote is to decide to which country they will belong.

PERUGIA, the chief town of the province of Perugia, in Italy, is built on a high hill on the western bank of the Tiber, 90 miles north of Rome. It is surrounded by walls in the form of a polygon. The main streets are wide, and the squares are lined by massive old buildings. The site of the former citadel is occupied by a substantial block of modern public offices. The city contains a fine Gothic cathedral with several paintings, a reputed wedding ring of the Virgin, a library of rare MSS., and the tombs of three popes—Innocent III., Urban IV., and Martin IV.; other churches, some of which have fine paintings; a well-endowed and long-established university, attended by about 80 students, and possessing a fine library, a botanical garden, a collection of minerals, and a cabinet of antiquities rich in Etruscan inscriptions, bronzes, vases, and medals. There are also an academy of the fine arts, several private galleries of paintings, theatre, two bathing establishments, and the house of Perugino the painter. The centre of interest in the city is the Piazza del Duomo. On the one side stands the cathedral, and on the other the Palazzo Pubblico, presenting a fine Gothic façade of the first half of the fourteenth century. In the centre of the Piazza is a fine marble fountain, constructed in 1277, and adorned with bas-reliefs, sculptured by Niccolò and Giovanni Pisano. Adjoining the Palazzo Pubblico is the old exchange, on the decoration of which Perugino put forth the full force of his genius. Numerous visitors are attracted to the city by its agreeable society and abundant works of art. The population in 1882 was 51,354. The circumference of the wall is above 5 miles, but much of the area within is open and un-built upon. Perugia has some manufactories of silks, woollens, and soap, and distilleries of brandy and liqueurs; but the principal trade consists in the products of its fertile territory, corn, wine, oil, wool, and cattle. The fairs in August and November, for cattle and merchandise, are frequented by a concourse of people from all parts of Central Italy.

Perugia was one of the twelve cities of the Etruscan confederacy which we meet with almost at the opening of Roman history. Its strong position on an isolated hill made it easily defensible, and it long resisted the Roman arms. Many Etruscan tombs and Etruscan antiquities have been and still are found in the neighbourhood of Perugia. In the civil wars Lucius, the brother of Mark Antony, occupied it and held it against Octavianus for several months, from the end of B.C. 41 to the spring of B.C. 40. He was starved into surrender, but set fire to the place on giving it up, and it was entirely destroyed. This was the "War of Perugia" (*bellum Perusinum*). Octavian, when emperor (Augustus) had the town rebuilt, and added the name Augusta as a commemoration. Part of the Augustan walls and gates still remain; one gate is especially in fine preservation. Perugia was annexed to the papal dominion by Julius II. in 1512. The famous painter Vannucci, surnamed Perugino, derives his sobriquet from his connection with this city, but was not born there, as is often wrongly stated.

PERUGINO, PIETRO, the famous painter, and teacher of the great Raffaele, derives the name by which he is best known from the city where he chiefly gained his fame. His own name was Pietro Vannucci. He was the son of Cristoforo Vannucci, and was born in 1446 at Città della Pieve. He was sent to Perugia at an early age to learn painting, his master being possibly Benedetto di Bonfigli (born circa 1425, died circa 1496). Afterwards he is said to have been employed by Piero della Francesca. He eventually came to Florence, fell under the influence of Verrocchio, and studied much in the Brancacci Chapel, where are the wonderful frescoes of Masaccio. Nevertheless he remained a pure Umbrian to the end, the Florentine elements in his work being merely technical. The round Madonna picture in the Louvre is a good type of his early style. In 1475 Perugino was at Perugia, and again in 1482, some of the intervening time being spent at Florence. In 1484 he went to Rome and painted frescoes in the Sistine Chapel, returning to Florence in 1489, where he settled for some time and made rapid and continuous advance in his art, the famous "Pieta" (dead Christ) in the Pitti being a work of the year 1495. Perugino was at Venice in 1494 and in 1496. In 1498 he was again at Florence. In 1499 he was at Perugia, finishing the frescoes in the Sala del Cambio, and at the end of that year or the beginning of the next, Raffaele entered his studio as an assistant. At the end of 1502 Perugino went to Florence, and there spent most of the time up to 1506, when he again settled at Perugia and worked there and in the neighbourhood. His assumption of a patronizing air towards the young Michelangelo galled that proud young spirit so keenly that, conscious of a higher ideal than that of Perugino, he called the latter a bungler in art (*Ital. goffo*) to his face. Perugino was foolish enough to go to law upon this matter, and his defeat did not improve his position, already shaken. In 1507 or 1508 he was called to Rome to paint in the Vatican. A year or two later he was on his wanderings again, visiting Assisi, and in 1510 Siena and Florence; for the far superior genius of his pupil Raffaele had caused the Vatican work to be transferred to the latter from Perugino. In 1512 he bought property at Perugia and settled there. He died of a pestilence at Fontignano in 1524. The main characteristics of Perugino's work are those of Raffaele in his early manner, sweetness, tenderness, and religious spirituality of expression, accuracy of perspective, and delicacy and purity of colouring. A peculiar "dancing-master" position of the feet is repeated by Perugino almost *ad nauseam*. It is found also in most of Raffaele's early works, even in the grand "Ansidei Madonna" of the National Gallery. This collection is as yet not well representative of Perugino at his best.

PERUVIAN BARK. See CINCHONA.

PERUZZI, BALDASSARE, a famous Italian painter and architect, was a member of the well-known noble family of Florence. He was born at Siena in 1481. In painting he was especially famous as a decorative artist; but his fresco at Siena of "Augustus and the Sibyl," to say nothing of his other works, shows that he was a painter of the widest range. The ceilings of the Farnesina, and of the Stanza d'Elidoro in the Vatican, by Peruzzi, are much admired, and in each case his work is in direct juxtaposition with that of Raffaele himself. As an architect he produced the beautiful Villa Farnesina at Rome and many of the best palaces at Siena. His masterpiece is certainly the Villa Massimi at Rome. Peruzzi was also engaged after Raffaele upon the mighty fabric of St. Peter's, and died while at work in this task, 1537. A drawing by this master at the National Gallery is of great interest. It is on the "Adoration of the Magi," and the three kings are the three friends and contemporaries of Peruzzi, Michelangelo, Raffaele, and Titian.

PESARO, a fortified and well built town and a bishop's see of Italy, in a province of the same name, situated on the railway from Bologna to Ancona, has wide streets, several churches with some good paintings, a fine market-place, several palaces of the nobility, the palace of the former dukes; a public library, with a museum and a cabinet of models; two hospitals, a foundling asylum, and a theatre. Pesaro has a small harbour on the Adriatic Sea, several manufactures of silks, pottery, glass, leather, and woollens, and 20,000 inhabitants. The country in the vicinity is fruitful and beautiful, the figs in the district being esteemed the best in Italy.

Pisaurum was a Roman colony. It is noticed by Catullus—
"Moribunda sede Pisauri."—*Carm.* 82.

But the defects in its climate, which made it so characterized, have been to a considerable extent obviated by the drainage of some adjacent marshes. The famous musical composer, Rossini, was a native of, and resident in, this town.

PESCHIERA, a very strongly fortified town of Italy, partly on an island and partly on the right bank of the Mincio, near the Lake de Garda, in the province and 20 miles N.N.W. of Mantua. The town itself is only a poor place of about 2000 inhabitants, but the fortress is exceedingly strong, and covers the approaches by the river.

PESETA, the unit of value in Spain, is as far as the etymology of the word goes a diminutive of *PISO*. Its former value was slightly different to the present, which was fixed in 1868 at the standard of the franc, lira, drachma, &c., of the Latin monetary union. The five-peseta piece (struck both in gold and silver) is called a piastre or dollar, and foreign exchanges are quoted in piastres (dollars) rather than in pesetas as a rule, though all accounts are reckoned in pesetas. The peseta, like the franc, &c., is divided into 100 parts (*centimos*). True to Spanish conservatism, the previous monetary law was never repealed, consequently the old coinage of *doublons*, *duros*, *escudos*, &c., long remained in force beside the new decimal coinage, to the great confusion of the unwary traveller. The Peruvian peseta has the same value as the Spanish.

PESHAWAR, a British district in the Lieutenant-governorship of the Punjab, lying between 33° 43' and 34° 31' N. lat., and between 71° 25' and 72° 47' E. lon. The area is 2497 square miles, and the population 550,000. Peshawar is the central district in the division of the same name. It is almost entirely surrounded by independent hill tribes, all of whom are of Pathan origin. The administrative headquarters are at the city of Peshawar. The staple crops are—wheat, barley, oil-seeds, maize, millets, rice, cotton, and sugar. Agricultural knowledge is very backward, the rotation of crops being only known in its simplest elements.

Medical Aspects.—The climate of the Peshawar valley naturally varies much with the elevation and other physical peculiarities. In the high and open uplands of Yusafzai the air is fresh and buoyant; but in the low-lying central hollow the land is saturated with the overflow of the Swat and the Cabul, so that the atmosphere becomes heavy and damp, chilling in winter, and laden with warm moisture in the hot season. In the greater part of the valley, shut in as it is by high walls of rock, the air is singularly stagnant and motionless. The city itself has a bad reputation for fever and cholera.

PESHAWAR, a city, municipality, and the administrative headquarters of Peshawar district, Punjab, with 60,000 inhabitants, is situated in a small plain near the left bank of the Bara stream, $13\frac{1}{2}$ miles south-east of the junction of the Swat and Cabul rivers, and $10\frac{1}{2}$ miles from Janrud fort at the entrance of the Khyber (Khyber) Pass. The distance from Lahore is 276 miles, and from Cabul 190 miles. Buddhist remains still mark its early greatness. The modern city has but slight architectural pretensions, the houses being chiefly built of small bricks or mud held together by a wooden framework, and the streets irregular, often ending in tortuous blind-alleys. A mud wall, 10 feet high, surrounds the city, chiefly as a protection from robbers. There are several mosques; a large building known as the Ghor Khatri, once a Buddhist monastery, then a Hindu temple, now used as a *sarai*, and containing the *tahsil*. Just without the wall, on the northern side, a quadrilateral fort, the Bala Hissar, crowns a small eminence completely dominating the city. Its walls of sun-dried brick rise to a height of 92 feet above the ground, with a *fausse-braye* of 30 feet; bastions stand at each corner and on three of the faces, while an armament of guns and mortars is mounted above. The population is very mixed, and is subdivided into petty trade-guilds recruited from all the races of the north-western frontier. Commercially Peshawar possesses less importance than might be expected from its situation. The principal foreign markets with which it has dealings are Cabul and Bokhara. There is a large through trade from Central Asia to the Indian towns, for the purpose of retaining which upon the spot a fair was unsuccessfully set on foot in 1869.

PESHITO is the name given to a Syriac translation of the Old Testament and most of the books of the New, which dates from a very early period of Christian history. That of the Old Testament is referred to by Ephraem the Syrian, writing in the latter half of the fourth century, as "our version," and it had then been so long in use that he found it necessary in his commentaries to give explanations of terms that had become obsolete. It was made direct from the Hebrew by men familiar with the Palestinian mode of explanation, and possesses the peculiar value of being the first version from the Hebrew original made for Christian use. Concerning the New Testament portion it is an admitted fact that a version of some of the books in Syriac existed as early as the second century, but the only texts known to scholars exhibit the work of different hands, and while some portions are of undoubtedly high antiquity, there are others which are unmistakably point to a later period. The books wanting in the original version were the 2nd Epistle of Peter, the 2nd and 3rd of John, that of Jude, and the Apocalypse. The text of the Peshito version differs from all the chief families of MSS., and each in succession has claimed it. It is of very great critical value, and several ancient Arabic versions and the Persian version of the Gospels were made from the Peshito.

PE'SO (Spanish, "weight," compare our *pound*), the former name of an old Spanish coin weighing an ounce, afterwards called a dollar or piastre; not to be confounded with the new piastre of five pesetas. In Mexico, Chili, and the United States of Colombia the peso is the unit of value and account. The Mexican peso (often called "dollar")

is coined both in gold and silver by the monetary law of 1867, silver being reckoned the standard. The gold coin weighs 1.692 gramme, .875 fine, and is therefore worth 4s. $0\frac{3}{4}$ d. sterling. The silver coin weighs 27.073 grammes, .9021 fine, and is worth 4s. $3\frac{1}{4}$ d. sterling; its quality is very regular, and it consequently enjoys a great reputation.

The Chilean peso is regulated by the law of October, 1870; and in gold weighs 1.525 gramme, .900 fine, worth 3s. 9d. sterling; in silver it weighs 25 grammes, .900 fine, and is worth exactly the same as the five-franc piece of the Latin monetary convention (France, Italy, Belgium, Spain, Switzerland, and Greece). The Colombian peso, by a monetary law of June, 1871, was also made equal to the Latin convention five-franc piece. The peso of the Philippine Islands is worth 4s. $0\frac{3}{4}$ d., the same as the Mexican. It is more usually called *escudillo*. It is divided into 100 *centavos*. The peso of Uruguay is more often called *piastre*. It is always in silver (Uruguay has no gold coinage), and is precisely equal to the five-franc piece. To distinguish actual coin from paper money in South America it is usually called *peso duro*.

PE'SSINISM, the most modern (and dare one not say the most foolishly irreverent) of all the philosophical systems, which proposes as its dreary theme the thesis that it is better the world should not exist than that it should exist. It is exactly and precisely the opposite to OPTIMISM (Lat. *optimus*, best), which teaches the hopeful doctrine that we are the children of a beneficent providence, and inhabit the best of possible worlds, where evil, if it true exists, but exists only as the necessary source of good; for pessimism (Lat. *pessimus*, worst) teaches the doctrine of despair, that this is the worst of all possible worlds, so bad that were it only a trifle worse all men would flatly refuse to inhabit such a place of torture. All life, says Schopenhauer, inventor of this dreary creed, whose life was not altogether in harmony with it [see SCHOPENHAUER] is perpetual suffering, partly pitiable, and partly dreadful. It may be worked into a beautiful form as an object of contemplation, and this is the mission of art: then one neutralizes the misery by aestheticizing it, just as to a surgeon a repulsive case of festering wounds becomes deeply interesting and in a sense beautiful. But such relief from the consciousness of the universal wretchedness is but momentary, and Schopenhauer quite logically affirms that the highest ethical work of man is to extend this by greater knowledge of life, until the will lays itself down and refuses to exist longer. The will is with Schopenhauer the reality of life. At the first moment the asceticism which evidently is the means of attaining this willlessness resembles the Nirvana of the Buddhists; but an instant's thought sets it irrevocably below that conception. To attain Nirvana is to be elevated into harmony with the ruler of the world, to will with him, to lose all power of opposition to his will, because all desire of opposition has gone—in fact it is a gigantic affirmation. To attain the annihilation of will advocated as the best thing desirable by Schopenhauer, is on the contrary to refuse further effort to understand the will of the ruler of the world, to cast away volition altogether, to acquire a sort of dumb contemptuousness with regard to all things—in fact it is a gigantic negation. There are various developments of pessimism by various philosophers; Von Hartmann ("Philosophy of the Unconscious," 1869) is the most important next to Schopenhauer ("The World as Will and Idea," 1819). But the base ingratitude and the wilful blindness of men who close the avenues of the soul to all that is good and bright and beautiful in this world of ours and of God's is too great to need further exposition.

PESTALOZZI, JOHN HENRY, the greatest educational reformer and one of the most lovable and loving-hearted of men, was born at Zurich in 1746. In curious contrast with the lonely motherless Froebel (his almost

equally great successor), Pestalozzi was a lonely fatherless boy. His father died when he was six years old, and his whole boyhood was therefore spent in the emotional atmosphere of a home ruled over by a tenderly affectionate mother and a doting maid-servant. His heart could not have had a better school, but his head suffered. His natural excitability, his fervent imagination, and his keen emotions grew to be his masters instead of his servants, and thus marred, by clouding his judgment, what would have been otherwise perhaps the most beneficent career among mortals. Invariably where Pestalozzi errs, it is through excess of emotional fervour and lack of cool judgment, and bitterly as he always paid for his follies, he never could learn in later years the prudence which he had not been taught in youth. Once, for instance, when he was in want of common necessities, and had been to borrow a few pounds of a friend, he met a peasant in great grief for the loss of a cow. He thrust the whole of the money into his hands, and hurried off to escape his thanks. This will serve to show the absurdly unworldly nature of the man, and at the same time to account for that marvellous hold over children and unsophisticated natures which he invariably gained, almost at the first contact with them.

During the whole of his school-life Pestalozzi was hopelessly inaccurate, and though meaning always to be the best boy in the school he yet made mistakes which the worst boys did not commit. When he was fifteen, and the first faint breezes of the Revolution were felt, he joined a league with Lavater and other youths against the unworthy governors of the canton; and determining to carry on this crusade in favour of the poor and down-trodden as his life's aim, he chose the profession of a clergyman as the best for his purpose. Unfortunately he went wrong in repeating the Lord's Prayer, and was so promptly rejected in consequence that he abandoned theology for law. Not long after, he felt that he could do more good as a farmer than a lawyer, and promptly renounced books for the open fields. After having studied his new occupation a little while he induced a firm of Zurich merchants to advance him the purchase money for some poor land near the village of Birr, which he felt sure would grow madder well. He bought the land in 1767, and built himself a house upon it, which he called Neuhof. Two years later he married Fräulein Schultheiss, a handsome lady of a wealthy family of some consideration. As Pestalozzi had no outward personal attractions, no property, and no position whatever, this union would appear to be rather one-sided. Love letters of his exist which are charmingly naïve, wherein he points out all these things, all his inaccurate ways of thought, his improvident habits, his vague schemes which may ruin him, his lack of care for social refinements, &c., making conscientious avowal of all to his discredit, in order that his "dearest Schultheiss" shall not be deceived. "If the fruits," he says "which it is my duty to mention diminish your respect for me, you will still esteem my sincerity, and you will not think less highly of me that I did not take advantage of your want of acquaintance with my character for the attainment of my inmost wishes." This original lover, who sets out by declaring everything against himself, and warning his bride that he may ruin her fortune, he himself having none to lose, nevertheless gained his prize, and Frau Pestalozzi was his faithful and affectionate partner for half a century.

The ruin foretold was not long in coming. The madder scheme of course failed, and the Zurich firm, growing suspicious, sent to examine the farm; a proceeding which resulted in their immediately demanding their money back, or so much of it as they could get. Pestalozzi satisfied his creditors very honourably, and endeavoured to work the farm himself; but it was evident, as he confesses, that he was incapable of any kind of undertaking which required

practical ability. Therefore in 1775, by way of a more practical scheme, he relinquished ordinary farming and started a philanthropic school. The fifty peasant children who flocked to him were boarded, clothed, and taught by him entirely at his own expense, and worked out their cost, or so he reckoned, by tilling the farm in summer and by spinning and so forth in winter. The children ran away with the new clothes, tricked and cheated their noble-hearted benefactor in every way, and a very short time saw nearly the whole of Frau Pestalozzi's fortune gone, and Pestalozzi deeply in debt. What was worse to him, the school, or whatever one should call it, had to cease (1780), and for eighteen years the ardent philanthropist and patriot saw himself deprived through grinding poverty of all power to influence the lives of his fellow-citizens for their greater happiness, which still remained the dream of his life. He had, however, pens and paper. Out of the wrestlings with doubt and despair came the deep aphoristic truths of the "Evening hour of a Hermit," which made him first known as an author in 1780, and which are well worth reading as the basis of a truly moral and religious education. This book, good as it is, was altogether surpassed by the charming "Leinhard und Gertrud," best known in England as "Leonard and Gertrude," which appeared in 1781, and is an astonishingly accurate and sympathetic delineation, in the form of a romance, of the peasant life of the Switzerland of Pestalozzi's day. We still wait for a good English translation of this remarkably fascinating book. The Agricultural Society of Bern sent the author its gold medal, and the liveliest interest was aroused in the subject and in the noble enthusiast who presented it. For, many and disastrous as were his practical failures, there was never anything wrong with the theories of Pestalozzi. He saw the thing to be done, and the way to do it; he failed only in the carrying out of his ideas, and that always through the very loquaciousness of his character. Other educational and philanthropic works also appeared, fruits of the enforced retirement at Neuhof, and Pestalozzi became in a very small way a power in the land. When, therefore, the contagion of the French Revolution spread, and the Swiss cantons were in 1798 centralized under a Directory of five on the French pattern, Pestalozzi, who had some years before joined a republican club in the hope of attaining some approach to an equality of conditions among men, thought that the new party really meant all that they so vividly expounded and declaimed, and enthusiastically joined their ranks. In reality, as we now know, they were mere puppets in the hands of France, used for the most selfish purposes, and proving eventually the cause of infinite bloodshed, plunder, and ruin of their country at the hands of the oligarchy led formally or informally by Bonaparte. But at the moment all seemed as promising as it was new, and Pestalozzi was most useful to the Swiss Directory in preaching the doctrine of "Liberty, Equality, Fraternity," which all men knew he, whatever might be the case with the rest, really ardently desired. His fellow-revolutionaries assumed that he was acting in like spirit with themselves; and when they asked him what post he desired as his reward in the new order of things, they were astounded to be answered that he desired to be a schoolmaster! It happened that the Catholic canton of Unterwalden was disinclined to the governmental change, and the usual revolutionary tactics of conversion by fire and sword were put in force. Among other towns Stanz was burned to the ground, in great part, and large numbers of the adult male population perished. One of the directors, Legrand, suggested to Pestalozzi that if he were really in earnest he had plenty of matter to his hands at Stanz. Pestalozzi eagerly rushed to the work. He had a large unfinished Ursuline convent given him, only one room of which was habitable when he arrived. Some eighty children, mostly orphans, were congregated there, homeless,

penniless, dirty, in rags, and hopelessly ignorant. The commonest necessities were lacking; as for books or school appliances of any sort, they were lacking also. Pestalozzi simply lived among these children day and night; was father and mother to them; taught them and trained them almost entirely by oral methods performed. Frequently all went hungry together. Yet, when Altorf was in flames, the children, guided by Pestalozzi, and warned by him (just in the spirit of his love-letter of years gone by) of all the trouble it would be to them, made room in their great poverty for many orphans of Altorf, still worse off than themselves. The children were many of them filthy, some diseased, nearly all of them disposed to hate Pestalozzi as a Protestant and an official; but he soon thoroughly won their affection by the Christ-like simplicity of his spirit, and harmony and order prevailed. The wretchedly poor dietary, added to the fact of so many children living together, bred sickness by contagion and Pestalozzi, as was not to be wondered at, began to feel his task beyond his physical strength. The French army relieved him in the simplest way by turning school and schoolmaster out of doors in January, 1799, in the course of their military manoeuvres, and converting the convent into an hospital.

After a sojourn at a health resort to recruit his wasted energies, Pestalozzi returned to his school-work and taught in the poor schools of Burgdorf as a simple assistant. The director of the schools evinced much jealousy of his great associate, and eventually Pestalozzi, with his faithful friend Krüsi, obtained possession of the old castle at Burgdorf and set up a school there, which in 1802 received a government grant in aid. Here the principles evolved out of the necessities of Stanz were brought forward and perfected; and Pestalozzi, desirous of making known to the world his new doctrine, embodied it in a book which speedily became famous—"How Gertrude teaches her Children." Burgdorf was appreciated, and for a brief moment Pestalozzi was in great honour among his compatriots. He was even chosen a member of a political deputation sent to Paris, on the part of the entire Swiss people. In 1804 municipal alterations caused the school to be removed to Buchsee, and the teachers, strangely enough, elected another master (Fellenberg) as their principal. Probably the inherent vices of disorder which always pursued Pestalozzi, and so crippled his work, had disheartened these men. Nevertheless, when Pestalozzi obtained the Castle of Yverdon on the Lake of Neuchâtel, and again opened a great school, all the best of the Buchsee teachers repentantly returned to serve under his colours. Yverdon (usually, by a curiously frequent blunder, spelt Yverdun) very speedily rose to world-wide fame. The root-principle of the whole system of teaching was *Anschauung*, a word difficult to translate, though the term *Intuition* is frequently used as a fair approximation. The meaning sought to be conveyed is, that true knowledge has to be gained, and cannot be imparted. Instead of pouring facts, dates, and theories into the minds of the children as one pours water into a jug, children must be taught to discover things for themselves; the office of the teacher is to be assimilated to that of the gardener who trains the plant, which he is thus able to guide and influence, though he is quite unable to assist in the actual growth. Just as he cannot eat for the children, but he can provide the best food; so also he cannot form ideas for them, but he can provide the best material.

Pestalozzi taught much by object lessons, and wherever possible the thing itself was handled and looked at in preference to any picture. In arithmetic actual counting and grouping of objects was the first step, and the rules were evolved in practice, not taught. Each child appeared to invent its own rules, the teacher skillfully keeping in the background. All this is familiar enough now, but it was a new gospel then, and Pestalozzi's teachers were demanded

by all the crowned heads in Europe to come and organize their schools. Every one with any love for educational improvement flew to Yverdon at every opportunity to see the latest method of the great master, who changed almost from month to month. The repeated examinations and exhibitions before these visitors, and the continued changes, interrupted the school course, and Froebel, who had all the organizing faculty which Pestalozzi lacked, has left us a brilliant account of the evident and fatal weaknesses pervading Yverdon, noble effort as it was. Froebel himself may be said to have lit his own torch at the flame of Yverdon, as did so many others at this time. But the very fame of the place, the stir of visitors, the frequent change of teachers coming and going, and the large numbers of children who overflowed the town and neighbourhood, crowding into the classes of the castle, which was too small to hold them, brought it about that Pestalozzi was altogether overweighed. He had to leave much to separate teachers, and these grew opinionated and quarrelled among themselves. Jealousies within and without, and the usual Pestalozzian finance troubles, together with some serious scandals among the rival parties of teachers, which need not be detailed, brought down this great school, whose influence has been so far-reaching. A collected edition of Pestalozzi's works in fifteen volumes yielded a very large sum, but did not meet the whole of the debts. In 1825 Pestalozzi—poor, reviled, slandered, and with the burden of seventy-nine years—abandoned the Yverdon school to spend his last days in such peace as his troubles permitted. His "Swan's Song," a farewell to his labours, and an autobiographical work, both showed in 1826 that his pen had not lost its pith nor his soul its ardour. At his death, which happened at Brugg, in Aarau, 27th February, 1827, Pestalozzi saw his life a wreck and almost a disgrace. In reality it was a splendid career, and every succeeding year showed its true meaning. In 1816 celebrations of the hundredth anniversary of his birth throughout Germany and the whole educational world showed that the value of Pestalozzi was at last gauged. He had failed, time after time, to secure a permanent form for his educational theories; his life was a practical failure; in nothing had he succeeded—but he had done more than educate children, he had educated their educators, and the world is richer than it would have been had this great heart never beaten.

PESTH, the most populous city in Hungary, and now, together with BUDA, the capital of that country, is situated 132 miles south-east from Vienna, on the left bank of the Danube, which is here about 1500 feet broad. It is connected by a magnificent suspension bridge, erected by an English engineer in 1819, with the city of Buda, on the right bank of the river; there is also communication across the river by a railway bridge, and by a bridge connecting the manufacturing quarters, both of which were finished in 1875. There are also steam ferries in the summer. In the winter the river is passable on the ice. For many years there was a constant rivalry between Buda and Pesth as to their relative claims to be regarded as the capital of Hungary. In 1873, however, all these differences were settled by each yielding its individuality, and merging the towns into one capital. There is now one administration for both places, and the two, now to all intents and purposes one city, are united as the capital, under the title of Buda-Pesth. The city, happily placed as regards water communication, is fast becoming the centre of all the important railways, and its commercial advantages and the patriotism of its citizens seem combining to make it surpass every other European capital in the rate of its increase and development. New streets and handsome boulevards, paved with asphalt and intersected with tramways, have been laid out, while the mansions of the nobility equal any in Paris and Vienna. The river is lined with a very fine embankment, and there is a custom-house and

extensive docks and entrepôts. Among the twelve Catholic churches of Pesth, that of the university is distinguished by its fine steeple and excellent fresco paintings. The Greek church is one of the finest buildings in the city; the Calvinist places of worship are very plain edifices; a handsome Jews' synagogue was finished in 1863. Of the other public buildings, the following deserve notice: the Neugebäude, an immense edifice, now used as barracks and as an artillery depot; the national theatre, a very handsome structure and one of the best in Europe, capable of containing 3000 spectators; the national museum, and the university, which was founded in 1635 at Tynau, transferred by Maria Theresa in 1777 to Ofen, and in 1784 by Joseph II. to Pesth. It is the only one in Hungary, and is one of the most richly endowed in the world. It is attended on an average by 1000 students, has forty-nine professors, a library of 120,000 volumes, a cabinet of natural history, a collection of medals, a chemical laboratory, and an anatomical and pathological collection. Dependent on it are the botanic garden, the veterinary school, the university hospital, and the observatory at Ofen. The instruction in the university is entirely gratuitous. The National Museum, which is independent of the university, contains a fine library rich in Hungarian MSS., and a valuable collection of fossils, minerals, and other antiquities, coins and medals, numbering about 60,000 specimens, of which the Greek, Roman, and other antique silver medals exceed 12,000. There are also a Hungarian academy of sciences, devoted chiefly to the scientific cultivation of the Hungarian languages, Roman Catholic, Lutheran, and normal schools, and a Marxist gymnasium, civil and military hospitals, asylum for the insane, blind, and deaf mutes, and other charitable institutions. Pesth is said to be the most Jewish city in Europe. The city has silk, woollen, cotton, oil, leather, and tobacco factories, dye-works, and manufactures of meerschaum pipe bowls, jewelry, and musical instruments; that of tobacco is a government monopoly. The distilling of brandy, and the grinding of grain into meal and flour, are also among the most important branches of industry. The railway connects Pesth with Vienna and all the principal places in Hungary. The river traffic is also very extensive; and next to Vienna it has the largest business of any place on the Danube. A great trade is carried on in printing and bookselling, and there are four large fairs annually, each of which lasts a fortnight. The principal articles sold are the manufactures, cattle, wine, wool, tobacco, raw hides, honey, wax, &c. The environs are not picturesque, the city being situated on a sandy plain, but there are some fine promenades. Immediately around the town is the *Rakosfeld*, a wide level tract on which the Hungarian Diets were held for many centuries. It is now used as a racecourse on the English model. The population, the majority of whom are Roman Catholics, amounts to about 100,000, but including Buda and the rapidly-spreading suburbs of the united capital, the number in 1880 was 360,551. Pesth has been frequently laid waste by war, and was in the possession of the Turks for nearly 160 years. They were not finally expelled till 1686. At the beginning of the eighteenth century it was one of the most inconsiderable towns in Hungary. Its improvement may be dated from the reign of Maria Theresa, and has since been progressive and rapid. The winter of 1838 was disastrous to the city, about 1200 houses having been destroyed by the overflow of the Danube; but a few years effaced all traces of this devastation. On the 28th of September, 1848, the bitter hostility of the Hungarians to Austria was shown by the murder of the imperial commissioner, Count Lamberg, on the bridge of Buda-Pesth. Active insurrection followed; the town was taken and retaken by Austrian and Magyar. The royal palace, which crowned the heights of Ofen, and in which the Palatine used to hold his court; the Vienna

gate, the bastions and parapets of the fortress, were reduced to heaps of ruins by the bombardment of Görgey; and the Redouten-Saal of Pesth, and many others of its public buildings, were destroyed or greatly injured by the cannon of Windischgrätz. Near the suspension bridge is a mound about 200 feet high, formed of earth brought from every county in the kingdom. Up this the Emperor of Austria walked in 1867 waving his sword, and vowing to defend the country against all comers, after he had taken the coronation oath as King of Hungary.

PESTILENCE. See **PLAGUE** and **CHOLERA**.

PET'AL is the term applied to each of the divisions of the **COROLLA** in a flower, when they are free from one another, that is, when the corolla is polypetalous. The petals are frequently large, brilliantly coloured, or sweet-scented, attracting insects to the essential organs, the stamens and pistil, so as to secure cross-fertilization; after fertilization they frequently fall away.

PET'ALISM (Gr. *petalismos*) was the mode of banishment adopted by the Syracusans in ancient times, resembling greatly in many things the ostracism (*ostrakismos*) of the Athenians. It derived its name from the leaves (*petaloi*) of the olive whence was written the name of the obnoxious citizen at the voting. A sufficient majority at the petalism exiled an over-powerful citizen for five years.

PET'ASOS, the wide-brimmed hat for use in sunny weather among the ancient Greeks, familiar to us as often worn by *Hermes*, when it bears wings. The crown of the petasos was usually very small, so that the head did not enter it far. A broad strap, or two straps, descended beneath the chin, so that when the petasos was thrown off for coolness it hung behind the neck. Many of the ephæboi on horseback in the frieze of the Parthenon wear this most graceful of all male headgear.

PETAURUS. See **FLYING PHALANGER**.

PETECHIE are small spots of a dark red colour, produced by the effusion of drops of blood in the skin just below the cuticle. At first sight they look very like flea-bites, but they do not disappear when they are pressed with the finger. They usually indicate an altered state of the blood, and are often symptoms of very serious diseases, as in typhus fever (some varieties of which have hence been called petechial fever), scurvy, pupura, &c. They commonly appear also in very severe cases of small-pox, measles, and scarlet fever, and are among the worst symptoms by which those diseases are marked.

PETER, ST., THE APOSTLE, originally named *Simon*, was a native of northern Palestine, the son of a man named *Jonah* (whence he is referred to as *Simon Bar-Jonah*), a fisherman of the Lake of Galilee. From the Gospels we learn that *Simon* and his brother *Andrew* followed the same occupation as their father, and that they were partners with *John* and *James*, all four being disciples of *John the Baptist*. *Simon* was one of the first to accept the call of *Jesus* when he commenced his public ministry, and for some reason, not very clearly indicated, he appears from the outset to have held the first place among the apostles. In the Gospel narratives it is to him that *Jesus* speaks as the representative of the rest, and on some very solemn occasions he addresses *Jesus* in their name. The name *Peter* by which he is known in Christian history, is the Greek equivalent of the term *kēphas*, a Chaldean derivation from the Hebrew *kēph*, a rock, a title bestowed upon him by *Jesus* at the time when he was formally commissioned to act as an apostle (Mark iii. 16), and afterwards confirmed with much solemnity by *Jesus* on the occasion of *Simon's* recognition of him as the Messiah (Matt. xvi. 18, 19). It is unnecessary to refer to the familiar incidents of the life of *Peter* as recorded in the Gospels and in the Acts of the Apostles, but it is clear from the latter and from the Epistles that he retained in the early church the

ascendancy he had enjoyed as a follower of Jesus. The latest incident of his career recorded in the New Testament is that of his painful collision with the apostle Paul at the city of Antioch (Gal. ii. 11-15), and from this time to the date of the First Epistle of Peter there is no distinct notice of his place or work. From the Acts we learn that he devoted himself chiefly to the Jews as Paul did to the Gentiles, and there is a tradition, dating from the time of Origen at least, to the effect that he preached the gospel in all the countries mentioned in the introduction to the First Epistle. That he was married we know from the Gospels, and from 1 Cor. ix. 5, we learn that his wife was a believer, and accompanied him upon his travels, and there is a very ancient tradition preserved in ecclesiastical history to the effect that her name was Perpetua, that she bore him a daughter, and that she suffered martyrdom for the faith, being supported in the hour of trial by his exhortation. His name from an early period was associated with the churches of Corinth, Antioch, and Rome, and there is a general unanimity among the fathers to the effect that Peter suffered martyrdom at the latter city. The manner of his death is said to have been crucifixion, and it is stated that at his own request he was fastened to the cross with his head downward. The date of this event is unknown, but the earliest writers imply that it took place during the Neroian persecution. A tradition to the effect that Peter was bishop of Rome previous to his martyrdom was used at an early period in support of the claims of the Roman Church to supremacy, and this at the time of the Reformation led some Protestant scholars to deny that Peter had ever been at Rome at all. The first writer to advocate this view was Velerius, whose work was published in 1520, and it afterwards received the support of Salmasius, Spanheim, and others; but the majority of scholars, both Protestant and Catholic, agree in accepting the tradition as to the martyrdom of Peter at Rome, though some of the former deny that he was ever bishop of that city.

PETER, GENERAL EPISTLES OF, the name given to two epistles contained among the canonical books of the New Testament. The First Epistle is directed to "the elect who are sojourners of the dispersion in Pontus, Galatia, Cappadocia, Asia, and Bithynia," and its main design appears to have been to comfort these Christians during a period of severe trial. In the opening, the necessity, use, and transitory nature of earthly trial is set forth, and this is followed by an exhortation to believers to walk worthy of their vocation, following the example of Christ. The writer then gives a series of practical admonitions as to the duty of believers in the various relationships and positions of life, e.g. as citizens, slaves, husbands, wives, &c. In the next section there is a general exhortation to unanimity, peaceableness, and sanctification, enforced by a solemn warning as to the nearness of the Second Advent, and the epistle closes with an address to Christian pastors concerning their duties.

The external evidence in favour of this epistle is of the strongest kind. It is referred to in the Second Epistle, and testimony in its favour has been collected from Papias, Polycarp, Irenæus, Tertullian, Valentine, Clement of Alexandria, Origen, and Eusebius. Olshausen declares that "in all Christian antiquity no one doubted the genuineness of this epistle." In modern times the Tübingen critics have rejected it, and Baur ascribed it to an unknown writer on the Pauline side, placing its date about 100 A.D. Against this view, however, we may set the unbroken testimony of antiquity, and the fact that the internal evidence of the Petrine authorship of the epistle is in the opinion of the majority of scholars as strong as the external.

The Second Epistle of Peter stands upon very different ground as to genuineness and authenticity to the first. By the primitive church it was placed among the writings

termed "disputed," and it was not until the year 393 that it was formally admitted into the canon by the Council of Hippo. There is a very marked difference of style between the two epistles, and the second borrows largely from the Epistle of Jude. In addition to this it is not found in the Peshitto version. Coming down to more recent times the authenticity of the epistle was advocated by Michaelis, Hug, Lardner, Thiersch, and others, but rejected by Calvin, Grotius, Cajetan, Scaliger, Erasmus, Eichhorn, Neander, De Wette, Reuss, and some more recent critics. The matter of the epistle is unexceptionable, but the evidence seems to preponderate in favour of a later date than the apostolic period for its composition. By a few scholars, including Bunsen, Ullmann, and Lange, while the second chapter is rejected as an interpolation, the first and third are accepted as coming from the hand of Peter or as being written by his direction.

PETER I., OR THE GREAT, Emperor of Russia, was born on the 9th June, 1672, and was the only son of the Czar Alexis by his second wife. On the sudden death of Alexis in 1677, at the age of forty-six, his eldest son, Theodore, ascended the throne; but he was of a sickly feeble constitution, and died when Peter, whom he nominated heir to the crown, was in his tenth year, passing over an elder brother named Ivan, who was almost blind and deaf, and subject to convulsions. But their sister, the Princess Sophia, a woman of great abilities, though thoroughly unprincipled, stirred up a succession of revolts against Peter's authority, and finally succeeded in associating Ivan with him in the sovereignty, and herself with them as co-regent. To strengthen her authority she strove to degrade the character of Peter, keeping him in ignorance, and surrounding him with every temptation to excess and dissipation. At length, in 1689, his marriage with Eudoxia Feodorowna Lapuchin withdrew him in a great measure from the views which his sister had encouraged. A plot which she had formed for his assassination, along with his wife, mother, and sister, was betrayed to him by some soldiers; and through the assistance of General Gordon and other foreign officers, he succeeded in depriving his sister of power and compelling her to take the veil, while at the same time he banished her principal adherents to Siberia. Peter now set himself to improve his neglected education. He formed a close intimacy with a Genevese named Lefort, who explained to him the great superiority of trained and disciplined soldiers over savage barbarians. He in consequence conceived the daring plan of annihilating the Strelitz or native soldiery, whose intemperate conduct endangered his throne, and as a first step to the accomplishment of his purpose, formed a regiment on the European system, of which Lefort was appointed colonel; and Peter himself entered as a drummer, to give his people a lesson of subordination, and rose through all the intermediate ranks before he obtained a commission. He next commenced building some vessels for the purpose of wresting Azof, the key to the Black Sea, from the Turks. His first attack, in 1695, on this important stronghold was unsuccessful; but in 1696, having increased his fleet, he succeeded in obtaining possession of it, after a siege of two months. He now fitted out a splendid embassy to the States of Holland, accompanying it himself *incognito*. He soon afterwards proceeded to Saardam in the dress of a Dutch skipper, and engaged himself to a shipbuilder as a journeyman carpenter, under the name of Peter Michaeloff. He spent seven weeks in this employment, living all the time in a little shingle hut, and made his own bed and prepared his own food. Peter did not confine his attention to shipbuilding, but acquired some knowledge of surgery, mastered the Dutch language, and made considerable progress in mathematics and the science of fortification. He also visited a great number of literary, charitable, and scientific institutions and manufacturing establishments, examining

their machinery and operations with the utmost care, with the view of introducing them into his own empire. After spending nine months in Holland, he crossed over into England, mainly for the purpose of examining its dockyards and maritime establishments. He resided at Deptford, and was received with great attention by William III. Peter here directed his attention to engineering, and took into his service and despatched to Russia upwards of 500 engineers and skilled artificers (Ferguson the celebrated geometrician being among the number), for the purpose of carrying out a long-cherished project of opening a communication by locks and canals between the rivers Volga and Don and the Caspian Sea. In the latter end of 1698 Peter left England. On his way home he visited Vienna, but while there the news reached him of an insurrection of the Strelitz which had broken out in Moscow at the instigation of the Princess Sophia, but had been promptly suppressed by General Gordon. He hastened home with the utmost speed, punished with great severity the ringleaders of the mutiny, and succeeded in supplanting the Strelitz, those instruments of turbulence and insurrection, by twenty-seven new and well-disciplined regiments of infantry and two of cavalry. He next set about effecting other changes; he altered the commencement of the year from the 1st of September to the 1st of January—a proceeding which gave great offence to his people, and especially to the priests; modified their barbarous marriage customs, and introduced many other social and moral reforms. Moscow, the Russian capital, being ill adapted for commerce, Peter resolved to build a new metropolis. The spot which he selected for its site was at the mouth of the river Neva, adjoining the Gulf of Finland. The land belonged to Sweden, with whom he had no ground or even pretext for a quarrel. But Peter had no scruples about committing an act of robbery for the benefit of his people. Entering into an alliance with the kings of Poland and Denmark against Sweden, the czar, at the head of about 60,000 men, invaded the province of Ingria, and laid siege to the fortified town of Narva. Charles XII. hastened to the relief of the place at the head of only 9000 men, and defeated the Russians, capturing nearly 40,000 prisoners. Far from being dispirited at this reverse, however, Peter was only stimulated to redoubled exertions. In the midst of war with Sweden occurred an event which exercised an important influence upon his character and future career—his second marriage. Some years before this he had divorced his wife—who had been chosen for him in his boyhood—mainly, it is believed, because, being a woman of mean intellect, a slave of superstition and bigotry, she had thwarted his schemes and opposed herself to all his reforms. In 1699 he met with his future empress, a Livonian peasant girl who had been taken prisoner at the siege of Marienberg, and was now a servant in the family of Prince Menshikoff. He entered into conversation with her, and was so much captivated by her intelligence, cheerful and lively disposition, and amiable temper, that he soon after married her, and speedily found that she was in every way the wife he wanted. Soon after this event the death of the patriarch, or supreme head of the Russian Church, afforded the czar an opportunity of carrying out some long-projected changes in ecclesiastical affairs. He boldly abolished the office of patriarch, and placed himself at the head of the church—a step which has contributed greatly to augment the power of his successors, though it very naturally aggravated the discontent which his reforms had excited among the clergy. The war with Sweden still continued, but Peter at length succeeded in wresting the coveted provinces from his adversary, and commenced the erection of his new capital. The spot selected for its site was a miserable morass, liable at certain seasons to be flooded by the waters of the gulf—without building materials of any kind, with a

barren soil all around, and a climate of almost polar severity; but his indomitable resolution overcame these difficulties, and a splendid city rose on that dreary marsh, and henceforth became the seat of his colossal empire. The senate was transferred from Moscow to St. Petersburg in 1713, and the emperor's palace completed in 1715. Peter now became anxious for peace, but the Swedish king, indignant at the spoliation of his territory, was bent upon reprisals, and marched into Russia at the head of a powerful army, determined to dictate a treaty of peace at Moscow. The czar retreated slowly before the advancing enemy, drawing them on step by step into the heart of the barren country. But Charles was induced by the representations and promises of Mazeppa, the hetman of the Cossacks, to turn aside in order to reduce the Ukraine; and after losing many thousands of his men from cold, hunger, and disease, with the remnant of his army he laid siege in May, 1709, to the town of Pultowa, where in June his army was attacked and destroyed by the czar. [See PULTOWA.] Charles escaped to Bender, and took refuge among the Turks, whom he succeeded in persuading to declare war against Russia, with the view of recovering Azof and expelling the Russians from the Black Sea. Peter having levied an army of some 40,000 men, marched to the Turkish frontiers, accompanied by the czarina, whom he had just before publicly acknowledged as his wife. Relying on the promise of assistance from the hospodar of Moldavia, he crossed the Pruth, and advanced to the neighbourhood of Jassy. Here he found himself hemmed in on all sides, destitute of provisions, and with a rapid river rolling between him and his dominions. A desperate struggle ensued, which was protracted for three days, and cost him about 18,000 men. Peter gave up all for lost and shut himself up in his tent, where his wife found him struggling with one of the convulsive fits to which he was liable. She calmed his mind and cheered his spirit, and proposed that a negotiation should be attempted with the enemy. Her advice was followed, and her pearls and every article of value which the camp could furnish were sent as presents to the grand vizier. The Turkish general proved unexpectedly placable and moderate in his demands. Hostilities were immediately suspended, and peace was concluded on condition that Azof should be surrendered to the Turks, the czar excluded from the Black Sea, and the Russian army withdrawn beyond the Dnubie. The extraordinary services of Catharine were publicly acknowledged by the czar when she was subsequently crowned empress. His closing years were clouded by an occurrence which has given rise to much controversy, and left a stain upon his memory. His son Alexis by his first wife had been unwisely left to the guardianship of his mother. He was a young man of low intellect, but of a cunning and mischievous disposition, which had been still further degraded by a vicious education. When he was about twenty years of age his father sent him to travel, and on his return married him to an amiable and intelligent princess, who died in less than four years of a broken heart from his neglect and brutality. Peter, alarmed by some treasonable schemes which the youth had concocted, despatched messengers after him to Naples, where he had taken refuge, and they by a solemn assurance of his father's forgiveness induced him to accompany them to Russia. On his arrival at Moscow (February, 1718) he was publicly disinherited, arraigned for conspiring against his father's life and throne, found guilty, and condemned to death. Whether Peter intended to permit the execution of this sentence cannot now be known; but on hearing it read Alexis fell into a fit, from the effects of which he never recovered. He lingered some time, and died in prison on the 7th of July. In 1721 peace was concluded with Sweden on the mediation of

France and the provinces of Livonia, Esthonia, Ingria, Carelia, Wyburg, and the adjacent islands were ceded to Russia. On this occasion Peter, at the request of the senate, adopted the title of "Peter the Great, Emperor of all the Russias, and Father of his country." In 1722 he found a pretext for a quarrel with Persia, having coveted a portion of its territories, and entered upon a campaign which terminated in his acquisition of those beautiful and fertile provinces to the south of the Caspian Sea; and in 1724 he conducted a powerful fleet against Sweden to enforce certain claims on behalf of the Duke of Holstein. His life now drew near a close; but he busied himself to the last in schemes for the improvement of his empire, in protecting his new capital against inundations, in continuing the Ladoga Canal, in the erection of an academy of sciences, reforming the monasteries, and promoting the labours of the legislative body and the commerce of the country. At every period of his life Peter's character had been marred by the strong self-will which displayed itself on the least excuse, or without any at all; but in his later years this had been intensified by the lavish use of alcohol and stimulants, by the loss of the few friends who possessed any influence over him, and by the dissensions and discontent within his own family. He also became subject to fits of moroseness and suspicion, which repelled the sympathy of even his few immediate admirers. The last months of his life were passed in a succession of debauches, the effects of which were aggravated by his catching a severe chill from heroically rushing into a lake to save a sinking crew. These causes produced an inflammation of the bladder, from which he died on 8th February, 1725.

Like most of the great minds of a stormy age and a troubled society, Peter had many faults. His absolute authority brought into more prominent relief the qualities of self-reliance and of impatience of restraint which were natural to him, while his superior knowledge and experience led him to ignore such advice as his fellow-countrymen ever ventured to offer him. Even from Menschikoff he would not brook remonstrance, and the influence of his second wife and successor, Catharine, alone saved his memory from the deep stain of being the murderer of the friend of forty years. Peter's faults were such as would probably have been removed by education; the half education which was all he received served but to intensify them. Yet above and beyond all the shortcomings of a cruel temper and a barbarous coarseness, which were in consonance with the character and condition of his country, there remains the fact that Peter was a great and wise ruler, a man of high courage and singularly wide intelligence. In fact his life is almost a convertible phrase for the origin of Russian greatness. If it would be placing too slight a value on the latent resources of history to declare that had there been no Peter there would have been no Russia in the sense that she now exists, it is none the less true that he gave a people scarcely recovered from the dread of Tartar dominion and tyranny, living in daily fear of the Moslem on one side and of the Swede on the other, and governed by a proud, ignorant, and dissimulated aristocracy, increased material prosperity, just laws and a stable government, and a recognized place among the Great Powers of Europe. In the words of Voltaire, "He gave a polish to his people, and was himself a savage; he taught them the art of war, of which he was himself ignorant; from the sight of a small boat on the river Moskwa he erected a powerful fleet, made himself an expert shipwright, sailor, pilot, and commander; he changed the manners, customs, and laws of the Russians, and lives in their memory as the father of his country." (See "Peter the Great," by Eugene Schuyler, London, 1884.)

PETER II. Czar of Russia, grandson of Peter the Great. He was left in the guardianship of Menschikoff,

who affianced his daughter to the young czar. Peter felt the greatest repugnance to her, and in consequence, with the help of Dolgorouki, his tutor, caused Menschikoff to be arrested and banished to Siberia. His great wealth was forfeited, and he was only allowed out of it ten roubles a day for his support. Peter II. succeeded to the throne in 1727, but only reigned two years, having died in 1729, in the fifteenth year of his age.

PETER III. Czar of Russia, was another grandson of Peter the Great. He was born in 1726, and ascended the throne on the death of the Empress Elizabeth in 1761. He was deposed by his wife Catharine, and subsequently murdered, Catharine succeeding to the throne. See CATHARINE II.

PETER MARTYR, so named after a Milanese saint, but whose real surname was Verniglio, was born at Florence in the year 1500, and became an Augustinian monk in 1516, at Fiesole, close by that city. Afterwards he was successively Abbot of Spoleto, of the Augustinian Monastery of St. Peter ad Aram at Naples, and Prior of St. Fridian's Monastery at Lucca. About 1512 he left Italy in company with Ochinus, became a Protestant, and joined Martin Bucer at Strasburg. There, in 1546, he married a nun, and coming to England on the death of Henry VIII. was made regius professor of divinity at Oxford in 1549. This post he deserted on account of annoyances which he had to endure from the undergraduates, but consented to return to it on being also made canon of Christ Church. Queen Mary gave him a passport to return to Strasburg, where he became professor of divinity in 1553, and though invited to return to England on her death, he declined to do so, remaining at Zurich (where he had become the divinity professor in 1556) until his death in 1562. The nun whom he had married died at Oxford, but a few years before his own death he married again. The influence of Peter Martyr upon the anti Catholic party among the Reformers was very considerable; and while at Oxford his pen was constantly employed against the doctrine of Christ's presence in the Holy Eucharist as set forth in the First Prayer-book of Edward VI. He was also the principal working member of the commission which produced the *Reformatio Legum*, and appears to have used to a considerable extent the hints given by Bucer in his work on the "Kingdom of Christ."

PETER THE HERMIT, whose name is so inseparably interwoven with the origin of the Crusades, was born about the middle of the eleventh century at Amiens, in the province of Picardy in France. He was of good birth, and having received his education at Paris and in Italy, he took military service under the counts of Boulogne, and was engaged in the war against Flanders in 1071. Quitting the profession of arms, he married, and became the father of several children; but on his wife's decease he retired, in the first instance, to a convent, and then to a hermitage. Shut up there in solitude and silence, and brooding over the world of his own thoughts, imagination, which in Peter's case appears to have been a dominant influence, supplied fuel to the flame of enthusiastic reverie. He believed himself blest with special visions and the subject of peculiar revelations. Next, undertaking in such a frame of mind a pilgrimage to Jerusalem, he was filled with grief on beholding the sufferings to which, at the hands of the Saracens, the pilgrims thither were exposed; and he resolved to announce their miseries to Christendom. Peter the Hermit was a person of small stature and ungainly shape; but the fire of his eloquence, the strong faith and the enthusiasm which furnished him with a copious flow of language, made a greater impression in proportion to the weakness of the instrument. In a monkish cowl, with a woollen cloak over it, and riding barefoot on a mule Peter traversed Italy, France, and

other countries, everywhere rousing the enthusiasm that lay dormant in the hearts of all. At his summons awakened Europe rushed to arms for the subjugation of the Infidel and the rescue of the Holy Sepulchre. During the Council of Clermont, in 1095, the listening thousands shouted with one voice, "It is the will of God!" and impressed on their garments the sign of the cross. The First Crusade became an accomplished fact. The departure of the expedition was fixed for the 15th August, 1096; but ere that period arrived, a mighty host, amounting to close on 100,000 persons, left France for the East, with Peter the Hermit at their head, and Walter the Penniless as his lieutenant. Peter was only an enthusiast and an orator; he possessed the power of rousing, not that of leading vast masses of men. His army was beaten and dispersed at Senlin by the Hungarians, with whom he had rashly involved himself in hostilities; and it was with difficulty that he conducted to Constantinople the scattered remnant of his followers. Hastened by the Emperor Alexios across to Asia, they fell an easy prey to Soliman, who totally defeated them on the plains of Nice. Peter, however, had remained behind at Constantinople. Throughout the First Crusade the name of its great promoter is seldom prominent. At the siege of Antioch, in 1097, his enthusiasm appears to have flagged, and he made an ineffectual attempt to leave the camp of the crusaders. But, after the capture of Antioch, he accompanied the Christian army to Jerusalem, and delivered, we are informed, a discourse to the soldiers on the Mount of Olives. Returning to Europe, he founded a monastery near Huy, in the diocese of Liège, and there closed his strange and stormy career in peace. This singular personage died on the 7th July, 1116.

PETERBOROUGH, an episcopal city of England and a parliamentary borough, in the county of Northampton, 76 miles from London by the Great Northern Railway and other lines, is situated on the north bank of the river Nen, over which there is a bridge. The streets are regularly laid out, and well paved. At the time of the dissolution of the monasteries Peterborough was the site of one of the richest abbeys in the kingdom, founded in 655, out of which the present bishopric was formed. The cathedral and conventual buildings were much injured during the civil wars of Charles I. The former is chiefly of Norman architecture, with intermixture of later styles. The west front is Early English; the eastern aisle, perpendicular. It has double transepts, with a low central tower. Length, 476½ feet; width of the nave and aisles, 78 feet; height of the nave, 78 feet. The central tower, 150 feet in height, having become unsafe, was pulled down in 1883 and re-erected. A romantic interest also attaches to the minster as having been the burial-place of two unfortunate queens—Mary Queen of Scots, whose body was afterwards removed to Westminster Abbey, and Catharine of Aragon, whose remains still lie in the vault where they were interred. St. Mary's was erected in 1861, and in 1869 another church was opened for the locomotive establishment of the Great Northern Railway at New England, about a mile from the town. There are also some chapels and a training college for the dioceses of Peterborough and Lincoln. The Nen is navigable for boats, and a considerable trade is carried on in coal, corn, timber, bricks, stone, and lime. The municipality consists of six aldermen and eighteen councillors. Since 1885 the parliamentary borough has only returned one member to the House of Commons, having been deprived of one by the Redistribution of Seats Act passed in that year. The population in 1881 was 20,123. The town was anciently called *Medeshamstede*, the meadow homestead.

PETERHEAD, the most easterly town of Scotland, and a port, in the county and 32 miles N.N.E. of Aberdeen, and 587 from London by the Great North of

Scotland Railway. It stands on a peninsula running into the North Sea, on the south side of the mouth of the river Ugie; the north and south harbours are near the south-eastern extremity of the peninsula, on opposite sides of which they are formed. The south harbour is the oldest, having been formed in 1773. It covers about 6½ acres; the north harbour was formed in 1818, from a plan of Mr. Telford, and covers almost 11 acres; both are furnished with quays and protected by piers. They are connected together, and are considered the best on the east coast of Scotland, and in 1884 Peterhead was recommended as the best position for a national harbour of refuge. Between 1870 and 1880 a middle dock was formed, making the total dock accommodation 21 acres. Vessels can leave in any state of the wind. The town had in 1881, within the burgh limits (which include the suburbs of Ronheads and the village of Buchanlaven, both inhabited chiefly by fishermen), a population of 10,922, showing a large increase over the previous census, and the parish had a population of 14,257. There is an excellent supply of water, brought from a distance of about 2½ miles. The houses are generally of granite, which is quarried near the town. The principal public buildings are the town hall and the court-house. The market-cross is a granite pillar, of the Tuscan order. The church, built in 1803, has a spire 118 feet high. There are various other places of worship. The town was founded by the Keiths in 1593, and a statue of Marshal Keith was given to it by the King of Prussia in 1869. It was here that the Pretender landed in 1716. Cloth and winey are manufactured, shipbuilding is carried on, and there are extensive herring and cod fisheries. For many years the port was the chief depot for British whalers, but the business not proving profitable has considerably declined. The town has some mineral springs, and is frequented by summer visitors. The number of vessels registered as belonging to Peterhead in 1886 was 55 (7400 tons). The entries and clearances each average 900 (of 120,000 tons) per annum. Granite is exported in large quantities, and is celebrated for its durability and fine polish. Peterhead is a burgh of barony, erected by charter of the Earl Marischal in 1593. The municipal government is vested in a provost, three bailies, a treasurer, and seven councillors. Near the town are several picturesque ruined fortresses.

PETERLOO MASSACRE, the name given to the dispersal of a large reform meeting which assembled in St. Peter's Field, Manchester, on 16th July, 1819. The magistrates ordered several troops of cavalry to go to the place of meeting and disperse the crowd. Several persons were killed and numbers wounded. The term *Peterloo* was suggested by Waterloo, which then filled men's minds.

PETER'S CHURCH, ST., at Rome (that is, San Pietro in Vaticano, for there are several San Pietros in the Holy City), is the most famous and most beautiful Christian church. The earlier church was founded by Constantine the Great and consecrated by Pope Sylvester in 326, to commemorate the burial-place of St. Peter's body: the saint's head (as well as that of St. Paul) is said to be buried beneath the Church of St. John Lateran. The body is believed to lie beneath the high altar of the old church, still preserved; and the high altar in the present church is built above it at the raised level of the present nave, which is 11 feet above the old one. Early mass is said here daily in the crypt or "sagre grotte del Vaticano," and the function is so sought after by strangers that the resident clergy are never called upon to officiate. The old site was carefully preserved and was made the focus of the chapels of the crypt. It forms a small chapel in itself, dedicated to St. Peter and St. Paul, and is a simple blaze of gold jewels and precious stones, the offerings of the faithful. The veritable pavement of old St. Peter's lines the "sagre grotte," and many of the popes lie in stone

sarcophagi in its vaults and corridors; among them the only English pope of all the long line, namely, Nicholas Breakspear, "Adrian IV.," who died in 1159. Still more interesting to Englishmen are the sarcophagi of the three kings of England who never reigned—James III. (the "Old Pretender"), who died at Rome, 1st January, 1766; Charles III. (the "Young Pretender"), who also died at Rome, 31st January, 1788; and Henry IX. ("Cardinal York, and arch-presbyter of St. Peter's"), who died at Tuscanum, 13th July, 1807, the last of the ill-fated family of Stuart. The three monarchs rest in peace here, with their regal titles duly inscribed on the cover of their narrow realms.

The new Church of St. Peter's was planned by the noble-hearted Nicholas V., founder of the Vatican Library, and of much else that is most worthy in Rome. He built part of the eastern apse and transept. It was, however, not carried further, and had already become ruinous, when fifty years later, in 1506, Pope Julius II. removed it entirely, and laid the first stone of the present church on 18th April. His intention was to place a magnificent tomb of his own within the new structure, and the grandest figure of modern sculpture, the unique "Moses" of Michelangelo (now at St. Peter's of the Chains), was only one out of several such figures comprised in the colossal design. The architect was the great Bramante, and his plan was that of a Greek or equal-armed cross, probably with a dome over each arm. Leo X. (a Medic) took up the work of both pope and architect when they had passed away, and the great structure was turned over to Raffaele in 1511. Sangallo was associated with Raffaele, and continued for a short time alone as architect after the death of his great colleague in 1520. Peruzzi was nominated architect in 1520, and Michelangelo in 1541. Sangallo had lengthened an arm of St. Peter's, but Michelangelo returned to Bramante's equal-armed plan, and added the crowning glory of the magnificent dome, the finest roof of the kind in the world. He designed everything so thoroughly that when he died in 1564, before the dome was much higher than the drum, his successor Vignola found no difficulty in carrying it on; and it was finished strictly on Michelangelo's plan by Fontana and Della Porta, who next ruled the great structure, between 1588 and 1590. Carlo Maderno completed St. Peter's, all save the façade, in 1606. Hitherto Bramante and Michelangelo, two giants of art, had really designed the structure; the first laying down the plan, the second erecting upon it the finest church ever built, either by his own work or by successors working on his designs. Seen from the side, or from the back, or from a distance, or within, St. Peter's is magnificently grand beyond all criticism. But Paul V. with a wretched Maderno, and Alexander VII. with a more wretched Bernini, went as near spoiling this wonder of the world as was possible. First the nave was lengthened by one of the colossal bays by Maderno, having the effect of completely blocking out the dome except for a distant view, and thus ruining the constructive plan; then, although Michelangelo's design for a façade was in existence—ten colossal pillars bearing a nobly simple pediment, grand, majestic, and appropriate—Maderno was allowed to perpetrate the present iniquity in art in 1612. The church, at last practically finished by 1614, was dedicated with great solemnity by Urban VIII. in 1626. But then, as if Michelangelo were not to be suffered to rest in his grave, Alexander VII. commissioned Bernini to complete the overthrow of the exterior design by a huge tasteless colonnade (1661-67), dwarfing the really grand proportions of the church; while at the command of Urban VIII. the same spoiler had done his worst with the interior, with a gigantic ugly baldacchino of bronze over the high altar, which still blocks up the nave and prevents the size and glorious shape and lightness of the dome from being apprehended, and moreover is painful to

the thought as having been made of genuine ancient Roman metal of the time of Augustus, stripped from the roof of the Pantheon. No wonder the Roman satirist, alluding to Urban's family name, cried "Quod non fecerunt Barbari, fecit Barberini" (Barberini has done what the very barbarians were ashamed to do). Bernini even put up one of a pair of *campanili* (bell towers) meant to grace the two sides of the cathedral, most hideous to behold; but fortunately the foundations were insecure, and the earth had to be relieved of the unsightly burden or it would have fallen of itself. Lack of funds saved the world from a renewed attempt. The two campanili so long disfiguring the Pantheon were always known as "the asses' ears of Bernini," a name sufficiently descriptive of his success in architecture. In justice to the huge baldacchino, which stands 95 feet high, it must be held useful for one thing, namely, for partly concealing the *Cathedra Petri*, where St. Peter's preaching-chair is concealed in what is without doubt the gaudiest, tawdriest gilded monstrosity in all church architecture, filling up the apse or tribuna at the end of the basilica, and is, as one might suppose, a crowning effort of Bernini.

The size of St. Peter's is very great. Its floor within contains 26,163 square yards, just about twice the area of our own St. Paul's, which has 13,429 square yards. Milan Duomo measures 14,511. The dome of St. Peter's measures 435 feet from the present floor to the top of the cross. Its nave, though the longest in the world, has only three arches (Michelangelo would have limited it to two), but these are of immense span. The four piers supporting the dome measure 234 feet round. Everything is overlaid with costly coloured marbles, upon which decorations in white marble are overlaid. The cost of the whole church is said to have amounted to £10,000,000 sterling in all, and occupied twenty-two popes for 161 years, from Julius II. to Alexander VII., exclusive of the sacristy, which was erected in 1780 by Pius VI. at a cost of £180,000. St. Peter's might not seem dear even at that great price in money and time, did one not consider that it was chiefly the raising of the money for St. Peter's by Leo X. through the fatal system of the sale of indulgences which gave Luther his first foothold, and in the event brought about the desertion of nearly half the Christian people of Europe from the ancient communion of Rome.

The famed seated bronze statue of St. Peter, which is placed in the nave of the basilica, and whose projecting toe has frequently to be replaced, as it is worn away by the kisses of the faithful, is really a fine work of its style: it dates from the fifth century, and is of the stiffest archaic Byzantine type. The high altar of St. Peter's has one great peculiarity, it is approached from behind, i.e. from the east, so that when the Pope is officiating, with his face towards the consecrated elements, he is looking across the altar top to the people in the nave who are facing him. This position is rendered necessary by the position of the *confessio*. A fine statue of Pius VI. by Canova (1802), rests in a kneeling attitude on the floor of Old St. Peter's in this *confessio*, a large aperture made in the floor of the present nave, surrounded by a balustrade bearing eighty-nine ever burning lamps, and containing a double flight of stairs, at the foot of which are bronze gates opening on to the tomb of St. Peter in the crypt chapel already spoken of. The attitude of the Pope kneeling with hands outstretched towards these holy gates is very fine; and the statue ranks as one of the masterpieces of Canova. The *confessio* itself is imposing as an architectural effect; it is due to Maderno.

St. Peter's has three doors beneath the portico into the nave. The right hand one of these is the jubilee door, opened originally only at the jubilee once in fifty years, and afterwards once in twenty-five years. It has, however, remained closed since 1825, for in 1850 the Pope was

under the guard of French bayonets, which had just maintained him in Rome at the expense of the blood of Italian patriots, and the time served ill; while in 1875 the Pope had chosen to call himself a "prisoner," though in fact he is not only free, but is actually a sovereign prince within the limited domain of the Vatican and Castel Gandolfo, his country seat. The great œcumenical council of the entire Roman Catholic Church, famous as decreeing the latest Catholic doctrine, namely, the infallibility of the Pope, sat in the right transept of St. Peter's in 1870, a fact of itself calculated to show the immense size of the edifice.

Of course service is always going on somewhere or other in the vast cathedral. The duties are borne by a cardinal vicar (a post held by Monsignor Howard, an Englishman, in 1886), a vice-vicar, six archbishops-canon, thirty-six bishops-canon, thirty-six canons, twenty-six minor canons of title, and twenty six without title, and an army of simple priests, six of whom are vicars choral. The music is, however, sung entirely by engaged choristers, and except on Sundays and festivals is unaccompanied. On such occasions a movable organ is wheeled to where the choir is stationed, in a movable gallery; but as the organ is necessarily small the musical effect is rather diminished than increased. For the musical part of the services St. Peter's is excelled by some other churches in Rome, especially by St. John Lateran, where the organ is a good one, and stands in the tribuna; but a fine service in St. Peter's, among all the grandeur and impressiveness of the surroundings, and enhanced by the historic recollections which crowd upon the mind, will always command the deep and reverent homage of cultured minds.

PETER'S COLLEGE, ST., commonly called *Peter-house*, the earliest endowed college in the University of Cambridge, was founded in 1257 by Hugh de Balham, then sub-prior, afterwards Bishop of Ely, who having purchased two hostels, one of them belonging to the Friars of Penance, united them, and appropriated the building for the residence of students; but it was not till 1280, after his promotion to the see of Ely, that he endowed the college with revenues for the support of a master, fourteen fellows, two bible-clerks, and eight poor scholars. After his death a new college was built on the site of the two hostels, for which purpose the bishop left by will the sum of 300 marks; he gave them also the Church of St. Peter.

There are twenty-two scholarships, four of £80 a year, ten of £60, one of £50, four of £40, and three of £20. Some are given as entrance scholarships, tenable for two years at least, open to candidates under nineteen years of age; and the others are foundation scholarships for undergraduates in their first term (irrespective of age), tenable for three years at least. There is an exhibition from the Company of Clothworkers and another from the Company of Ironworkers; also the Miller Exhibition for boys from Huntingdon Free Grammar School, but thrown open if none such are qualified. There are eleven fellows, exclusive of supernumerary and honorary fellows. One fellowship is reserved for a university professor, and the others are given to graduates of the college unless the society think fit to elect from other graduates of Cambridge or of Oxford. A fellowship is tenable for six years only, but must be vacated one year after presentation to a college benefice of £400 or over.

This college stands on the west side of Trumpington Street, and was restored and remodelled by Sir G. Gilbert Scott—the object being to rid it of all modern additions and alterations, and reinstate it in something like its original appearance. The chapel windows have been fitted with painted glass executed at Munich.

PETER'S DAY, ST. (29th June), was formerly a great festival with our superstitious ancestors; great fires were lit on the eve preceding (as on St. John's or Midsummer Eve), and dancing round these fires was obligatory.

Even as late as 1733 the lawyers of the Middle Temple solemnly danced thrice round the fire, judges as well as sergeants and benchers. The ordinary people danced through the flames as well, and those who were vigorous enough earned good luck by jumping over them.

A curious old book of 1616 has preserved details of the Grand Watch of St. Peter's Eve (and also that of St. John's Eve), when in the city of London 2000 extra men paraded, as well as the ordinary watch, with drums and trumpets and much pageantry all through the night. This custom lasted from Henry III.'s time to that of Henry VIII.; and in one year subsequently, the year 1548, it was revived by Sir Thomas Gresham.

The origin of these festivals is lost in obscurity; it no doubt enshrined some war dance of our remote ancestors round the tribal fire, either of Teutons or of Celts. The nearest guess seems to be that the double festivity was in error, and that the fires and processions of St. Peter's Day were meant really for St. John's Day, the ancient ceremonies of the summer solstice, descended from the ancient Britons, and preserved by the peasantry.

PETER'S PENCE, an impost levied by the Pope in reverence of the memory of St. Peter. In the first instance it was the voluntary tribute of the faithful; but afterwards became in a measure compulsory, and was recognized in England by the laws of Edward the Confessor. It consisted in the payment of a silver penny by every one possessing land or cattle of the annual value of thirty pence, and was collected by the clergy yearly. It was abolished by Henry VIII. No other kingdom but England at one time paid Peter's pence, though tributes somewhat similar were levied in other European countries. Since 1818, however, Peter's pence, for the support of the holy see, have been voluntarily collected in most Roman Catholic communities.

PETERS, HUGH, one of the calumniated characters of history, was born at Fowey in Cornwall in 1599. He was educated at Cambridge, where he seems to have led a loose and disorderly life, so as at last to incur the penalty of public whipping and expulsion from the university. After this, it is said, he betook himself for some time to the stage, but through the preaching of Sibbs and other Puritan divines, he was brought under serious convictions, and became decidedly religious. He was ordained by Montaigne, bishop of London, and became lecturer at St. Sepulchre's-in-the-City, where he preached with great acceptance and success for a considerable period; until, having given offence by praying for the queen in words which seemed to intimate that he thought her in need of repentance, he was apprehended by Land and imprisoned. Through the intercession of some influential nobleman he, after some time, obtained his release, when he made his way to Holland, and then afterwards to America, where in 1635 he became pastor of a church at Salem. Both in Holland and in America his reputation was high and his influence great. After seven years' residence in the colony, he was sent over to England to "mediate for ease in customs and excise." He found the nation involved in the initiatory struggles of the great Civil War, and though he always intended returning to New England, his intention was continually frustrated by one cause after another in those unsettled times. Detained in England he became attached as a preacher to the Parliamentary army, and was with them in many of the great events of the memorable contest in which they were engaged. He was repeatedly sent to report proceedings to the Parliament, and more than once received commendations and rewards from that assembly. During the war Peters had several interviews with the king, and according to his own declaration made use of these to advise the king to measures which would have brought hostilities to an end and secured his crown, and Charles seems to have regarded Peters as his friend;

but when the Restoration took place, Peters was marked as an object of peculiar vengeance by the dominant party. On the 13th October, 1660, he was indicted for high treason, and though nothing was proved against him but certain strong and indiscreet expressions in reference to the late king, and though he protested and proved his innocence of any overt act against the king's person or throne, he was sentenced to death, and three days after was executed. There can be no doubt now that this was a judicial murder, to cover the iniquity of which the most unfounded calumnies have been propagated against him. Peters was not a wise man in all things; he was forward and hasty of speech; but he was a true and sincere man, a man of unblemished reputation in circles where nothing foul or mean was tolerated, and a man who in every respect was immensely the superior of those who busied themselves in seeking to attach infamy to his name.

PETERSBURG, a town of the United States of America, in Virginia, situated 23 miles S. by E. from Richmond, on the south bank of the Appomattox, about 12 miles from its junction with James River at City Point. It is the second town in Virginia in respect of population, and possesses extensive facilities for business. Vessels of 100 tons ascend the river to the town, and those of larger size to Waltham's Landing, 6 miles below. The South Side Railway has its east terminus at this place, and the Appomattox line connects it with City Point, at the mouth of the river, where the very largest vessels discharge their cargoes. Large quantities of flour and tobacco are exported. Petersburg is well built, and contains several churches, a public park, banks, cotton and tobacco factories, a woollen factory, rope-walks, iron-foundry, and numerous mills of various kinds, as the falls of the river, which arrest the ascent of the tide immediately above Petersburg, furnish extensive water-power. Around these falls a canal has been constructed, by which means small boats ascend the river for the distance of about 100 miles above Petersburg. The remains of the church of the village of Blandford, are among the most interesting and picturesque ruins of Virginia. During the American Civil War, Petersburg withstood a very protracted siege on the part of the Federals, who were defeated with great loss in more than one attempt to capture it; but it was ultimately taken on 2nd April, 1865, and as its surrender was immediately followed by that of Richmond, the event may be said to have ended the war. The population in 1880 was 21,656.

PETERSBURG, ST., a government of European Russia, bounded on the N. by the Gulf of Finland, Finland, and Lake Ladoga; on the E. by Novgorod; on the S. by Pskow; and on the W. by Lake Peipus and Esthonia.

The country is for the most part level, and in the north-east it is low and full of swamps and morasses. In the south it is rather more elevated. There are many forests, timber forming the chief source of wealth. The principal lakes are the Ladoga, Peipus, and Pskow; and the chief rivers are the Neva, the Luga, the Narova, and the Wolchow. The Neva, although only 40 miles long, is the most important, owing to its course through the city of St. Petersburg. The area of the government is 20,750 square miles; and the population, with the military government of Cronstadt, is 1,563,250, mostly Russians, but comprising many foreigners, the majority of whom are Lutherans.

The soil is mostly sandy and thin; and the climate damp, severe, and unhealthy. The agriculture is very limited, but much garden produce is raised in the vicinity of the metropolis. Geese and other poultry are reared in great numbers. The trade and manufactures are mostly confined to the capital. **ST. PETERSBURG** and **CRONSTADT** are the chief towns.

PETERSBURG, ST., the capital of the Russian Empire, is situated at the eastern extremity of the Gulf of Finland, upon the lower branches of the Neva. The population at

the census of 1881 was 929,100. In 1713 Peter the Great chose this spot, then just taken from the Swedes, for the site of a fortified seaport; but he afterwards perceived its fitness for a metropolis. At first all the public buildings and houses were of wood, and were huddled together without regard to regularity or convenience. But brick and stone buildings were soon after introduced; and the streets were laid out on a regular plan, crossing each other at right angles. This was greatly facilitated by the ravages of destructive fires in 1736 and 1737, which, having destroyed some thousands of old houses, enabled the government to lay down judicious regulations for their reconstruction. The Empress Elizabeth did much to improve the city, but it is chiefly indebted for its regularity, beauty, and magnificence to the Empress Catharine II. Under this princess the principal channel of the Neva was faced by noble granite quays; several new streets and canals were opened; and some of the finest public buildings and monuments were either erected or rebuilt on an improved plan.

The most considerable and the handsomest portion of St. Petersburg is the southern, on the left bank of the Neva; between this and the northern or right bank lie a group of islands covered with gardens, groves, avenues of trees, and country-houses, which in summer are the resort of the rich. Few cities have such long and broad streets. The one called the Nevski Prospect, 4 miles long and 130 feet wide, is one of the finest thoroughfares in Europe. It is lined on both sides with trees, and contains some of the handsomest and most colossal buildings in the capital. The houses are three and four storeys high, and embellished with gilded balconies, colonnades, and elegant porches. Another street is 10,000 feet long, and eight more are 6000 feet, with widths varying from 60 to 120 feet. The narrowest street in the city is 42 feet wide. There are many large squares; and the numerous public buildings, surmounted by gorgeous gold-plated domes, are massive and elegant; but the Italian style of architecture, which has been generally adopted, is unsuited to the climate. The streets are for the most part paved with stone; a few of the minor ones are, however, floored with logs of timber, and some macadamized. The foot pavements are generally very good; but the carriage-ways, in wet weather, become very dirty. Many of the brick houses are stuccoed and painted so as to have the appearance of stone, but the number of genuine stone private houses is very limited, and wooden ones still predominate. The better class of houses are covered with iron and copper, and the inferior ones with tiles. There are ten bridges over the Neva— which is as clear as crystal, and wider than the Thames at London Bridge—many of them richly decorated, as Isaac's Bridge, and some nearly 2500 feet long. Only one of them is permanent, the others being erected on boats, and removed whenever danger is apprehended from the ice, both at the beginning of the winter and in the spring. There are upwards of a hundred bridges over the various canals which intersect the city. Many of these are of granite, and the others of cast iron and wood. Two are handsome suspension bridges. None of them are remarkable for length, but some are architecturally handsome. The Armichkov consists of five arches, and is adorned by four excellent groups, in bronze, of wild horses and their Tartar hunters. The Nikolievski, built of granite, is 1200 feet in length, and consists of seven fine arches, with a drawbridge to admit of the passage of ships. The granite quays along the banks are almost unequalled in Europe for extent and beauty. There are 183 Russian-Greek churches, besides many private chapels and several churches of other Christian communities, Greek convents, a synagogue, and a mosque. Divine service is performed in fifteen languages. Of the Greek churches the finest is St. Isaac's Cathedral, of chaste and noble proportions, constructed en-

tirely of marble, and one of the largest ecclesiastical edifices built in modern times. It has one large and four smaller gilded domes. The Cathedral of our Lady of Kasan is built on the model of St. Peter's of Rome, and is one of the finest ornaments of the capital. The Church of the Convent of St. Alexander Nevski occupies the third place in rank among the churches of Russia. The mausoleum of the saint is of solid silver. A handsome Jewish synagogue—the first ever permitted in Russia—was erected in 1870. The number of palaces and public buildings is very great. The chief are—the Imperial Winter Palace (the largest in the world), in which the marriage of the Duke of Edinburgh and the Grand Duchess Marie was celebrated in 1874; Hermitage Palace, Marble Palace, Taurida Palace, Old Michailov Palace, New Michailov Palace, and the Admiralty, an immense brick building in the centre of the city, containing storerooms, docks for the construction of men-of-war, and a very extensive collection of objects connected with navigation. Its high gilt tower is one of the most striking objects in approaching St. Petersburg. There are also a splendid building belonging to the general staff, the Senate House, General Synod, City Hall, Post Office, Palace of the War Department, the Alexander Theatre, the Assignat Bank, the Arsenal, the Great Bazaar, the Academy of the Fine Arts, &c. Close to the quay is the colossal bronze equestrian statue of Peter the Great, on a vast mass of granite, which has been split by the frost. The czar is represented riding up the steep face of a rock, and checking the steed so as to make him rear at the instant of having gained the summit, an expressive personification of the natural difficulties encountered and overcome in founding the city. Opposite this, a long bridge leads to an island containing the exchange and custom house. The Citadel is on a small island in the Neva, which contains the Mint, the School of Mines, the Academies of Arts and Sciences, with museums, the fine astronomical and meteorological observatories (the former erected by the Emperor Nicholas, who caused it to be furnished with the best instruments), the barracks, and the Cathedral of St. Peter and St. Paul, in which are the tombs of all the Russian sovereigns since Peter the Great. On an adjacent island is the house in which Peter lived while the original town was being built. In the Grand Square is the column, rising to 150 feet, erected in honour of the Emperor Alexander, the shaft of which is a magnificent red granite monolith, the largest in the world, being 84 feet long and 14 feet thick. There is also a granite obelisk, 82 feet in height, to the memory of Romanzov. The Field of Mars, adorned with a statue of Suwarov, is extensive enough to allow 40,000 or 50,000 men to be reviewed in it. St. Petersburg contains a university, founded in 1819, five other colleges, many public and other schools, a medico-surgical academy of high reputation, Kalmuck Institution, Imperial Geographical Society, several gymnasia, seminaries, &c. The Imperial Public Library consists of above 450,000 volumes and 25,000 MSS., many of which are Oriental; the Academy of Sciences has a library of 110,000 volumes; and the School of Mines has a geological and mineralogical cabinet, said to be the most extensive in the world. Almost every establishment has its own library and museum, every one of the latter being richly stored with specimens. The Hermitage Palace, which was long the residence of Catharine II., contains the court theatre, a picture gallery occupying forty-one apartments, a valuable library of 120,000 volumes, and a rich museum. It is sometimes called the "Louvre" of St. Petersburg. The city has several first-class theatres, and an exceedingly handsome Italian opera house, a botanic garden, and a naval hospital. The number of charitable institutions is rivalled only by that of London. They consist chiefly of hospitals on a very large scale, and institutions for foundlings, deaf and dumb, and blind.

The Neva is open for navigation only about 220 days in

the year—from May to November; and as the city is built on a flat and marshy soil, its drainage is difficult, and it is subject to destructive inundations, during one of which, in 1824, 15,000 lives were lost. The river again rose nearly as high in October, 1873, but due precautions then adopted prevented loss of life. The mean temperature of the year at St. Petersburg is 35.6°; in summer 61.7°, and in winter, 18.6° Fahr. The cold in winter is intense, being sometimes 50° below zero, but the air is clear and bracing. The summer is bright and warm, though short; but the autumn is damp and disagreeable. Of the islands in the Neva, north of St. Petersburg, that of Krestovsky is the most beautiful; the isle of Yelagin has an imperial summer palace with a fine park. Peterhof, on the Bay of Cronstadt, the road to which is a noble causeway bordered by fine gardens and country-seats, has a large garden and fine water-works. Oranienbann, on the Gulf of Finland, is still more beautifully situated than Peterhof. At Tzar-skoe-Selo is a very magnificent imperial country-seat, with an immense park and noble gardens.

St. Petersburg is not only the capital, but the greatest manufacturing city in the empire. Private manufactures of various kinds are carried on, including silk, cotton, woollen, leather, glass, gold and silver articles, watches, surgical instruments, paper, snuff and tobacco, sugar, &c. There are others which the government has considered it advisable to carry on upon its own account; such are the great manufactory of tapestry, a large one of aquafortis, an assay office and a mint, plate glass and porcelain manufactories, and a cannon foundry and gunpowder mills.

The commerce is very considerable. Cronstadt is the harbour. The exports are corn, hemp, flax, tallow, leather, iron, copper, tobacco, timber, furs, hides, canvas, coarse linen, beeswax, linseed, linseed oil, tar, potash, &c. The imports are colonial produce of all kinds, manufactures of silk, wool, and cotton, hardware, French wines, jewelry, and all articles of luxury and fashion. The trade with England is greater than with any other country. The Great Bazaar of the city is said to have 10,000 merchants.

In 1885 a great maritime canal was opened to enable large vessels to come up to the city. The navigable entrance channel up the Bay of Cronstadt to the mouth of the Neva lies under the south side of Cronstadt, and is commanded by its batteries. A canal has been cut through the shallow bottom of the Gulf of Finland, all the way from Cronstadt to St. Petersburg. The line of this canal is from north-west to south-east; it may be said to run very nearly parallel to the coast line on the south side of the gulf, and about 3 miles distant from it. This line brings the canal to the south-west end of St. Petersburg, where there are a number of islands, which have formed themselves, in the course of ages, where the Bolshaya, or Great Neva, flows into the gulf. It is on these islands that the new port is formed. It is a very large harbour, and capable of almost any amount of extension, and is in connection with the whole railway system of Russia. One part of the scheme is that of a canal, on the south side of the city, to connect the maritime canal, as well as the new harbour, with the Neva, so that the large barges may pass, by a short route, to the river on the east, and thus avoid the bridges and traffic of the city. The whole length of the canal is about 18 miles. The longer portion of it is an open channel, which is made 350 feet wide at bottom; within the embankments the depth is 22 feet, and the width of the surface between the embankments is 700 feet. There is regular steam communication from St. Petersburg to all the principal ports of Europe, and it is connected by railway with Berlin, Moscow, Warsaw, &c. It receives merchandise from all parts of the Russian Empire and Central Asia by means of navigable rivers and canals; and one of its most characteristic features is the winter market, in which are seen enormous pyramids composed of the carcasses of cattle.

sheep, and pigs, fish, fowls, eggs, and butter frozen into solid masses. The country around being little better than a morass and forest, nearly everything required for subsistence has to be brought from a distance.

St. Petersburg, though one of the principal European cities, is only a century and three quarters old. It was founded by Peter the Great, 27th May, 1703, and some of the principal streets were laid out in 1712. The canals which drain its low and unwholesome marshes were constructed by Catharine II. The first brick house was erected by Count Golovkin in 1710. In 1736 a conflagration destroyed 2000 houses, and 4000 were swept away by a similar calamity in 1780. In June, 1862, property to the amount of nearly a million sterling was consumed by fire. The railway to Moscow was opened in 1851; to Berlin, in 1862; and in 1870 a line was finished by which the capital was connected with Odessa and Sebastopol, on the Black Sea. No European metropolis occupies a site so proximate to a cause of danger, with the single exception of Naples. Owing to its slight elevation above the ordinary level of the river, destructive inundations occur when a westerly gale blows for any length of time, as it opposes the exit of the stream, and drives up the waters of the Gulf of Finland into the channel. So certain is this result, under the circumstances, that when there is a prolonged gale from the westward, the state of the river is anxiously watched by the police authorities. For a brief period, in fine weather, at midsummer, St. Petersburg is a very enjoyable place to the stranger, especially at night, which is but a softened continuation of the day, and when the moonbeams, mingling with the strongly-reflected sunlight, invest the river, the quays, and palaces with a kind of unearthly beauty.

PETERSFIELD, a market-town of England, in Hampshire, 54 miles from London by the South-western Railway, and 16 east by south from Winchester. It is a clean agricultural town, and is well supplied with water. The trade is small, but it is a pleasant country place. It has a Norman church of the twelfth century, and a corn exchange, which also serves as a public hall. A statue of William III., once richly gilt, stands in the market-place. The population in 1881 was 2294. Until 1885 Petersfield and some surrounding parishes returned a member to the House of Commons, but it was deprived of separate representation by the Redistribution of Seats Act passed in that year.

PETERWARDEIN, the principal and frontier fortress of Austrian Slavonia, situated in the neighbourhood of some mountains and fruitful hills, on the right bank of the Danube, near the angle formed by the sudden change in the course of that river from due south to east. On a rock isolated on three sides stand the upper fortress and the hornwork: at the northern foot of the rock is the lower fortress, which includes what is properly the town, and is partly on a gentle slope. Peterwardein is a place of extraordinary strength, both by nature and art. The lower fortress has very broad and deep moats, which may be filled with water from the Danube, lofty walls, and many bastions and ravelins, by which it is separated on the south side from the two suburbs Ludwigsthal and Rochusthal. One principal street, and two others parallel to it, with a pretty extensive parade, form the whole town. The principal buildings are the arsenal, the residence of the commandant, and the Catholic church. The fortress is capable of containing a garrison of 10,000 men. It derives its name from Peter the Hermit, who marshalled the soldiers of the First Crusade at this place. Here, also, in 1716, the Austrians, under Prince Eugène, defeated the Turks, who then lost their last footing in Central Europe. Peterwardein is connected by a bridge of boats over the Danube with the Hungarian town of Neusatz on the opposite bank. This bridge is defended by a strong *tête du pont*.

PETIOLE is that part of the leaf commonly called the stalk. It is usually more or less cylindrical in form. The scales found on underground stem-structures, as bulbs, rhizomes, resemble petioles. In the acacia the petiole is flattened out into a leaf-like form, being then called a phyllode. The petioles of leaflets of compound leaves are called partial petioles or petiolules.

PÉTION DE VILLENEUVE, JÉRÔME, one of the principal leaders of the great French Revolution, was born at Chartres, 1753, and was one of the original deputies to the States-general of 1789, a body which soon claimed itself the "National Assembly." He had been a lawyer, but "left his gown and briefs at Chartres for a sterner sort of pleading; had not forgotten his violin though, being fond of music. His hair" (says Carlyle, "French Revolution") "is grizzled, though he is still young; convictions, beliefs placid, unalterable in that man; not hindmost of them their belief in himself." With one of his trenchant adjectives Carlyle elsewhere labels him "Dutch-built" ("the solid Dutch-built Pétion"), but though stont and clumsily-made the dulness was only on the surface, for Pétion was among the most active and influential of the deputies of the patriotic party. He presided over the Assembly occasionally, and when the labours of that body closed with the preparation for a new constitution, Pétion came over to England as a sort of informal ambassador to English sympathizers with the Revolution, and much haranguing and teasing occurred between him and the various Constitutional Reform Clubs of London (1791). He gained the sobriquet of "the virtuous Pétion," and his incorruptibility caused him to be selected as one of the commissioners sent by the National Assembly to bring back poor Louis and his family from Varennes, in that lamentable attempt of theirs, June, 1791, to escape from their enemies. That he fulfilled his task more humanely than the prejudiced Madame Campan would have us believe, is clear from the support he had at the hands of the court party when he stood for mayor of Paris in the following November. The proud high spirited Marie Antoinette would not have sought to favour Pétion against Lafayette, his competitor, had he amused himself at lunch, as they rolled back to Paris from Varennes, by flinging his chicken bones across the queen's face out of the window and insolently proclaiming the speedy arrival of a republic. He was elected mayor of Paris, perhaps the most important post at that moment, 4th November, 1791. The government (nominally royal) saw fit to suspend Pétion after the riot of the 20th June, 1792, when for hours a mob defiled through the Tuilleries, while the king and queen were pinned in a corner behind a table or so, hurriedly moved to keep off the crowd. But the indignation of revolutionary Paris, which "demonstrated" vociferously, wearing in its hat legends such as "Pétion or Death," &c., emboldened the Assembly to decree the re-appointment of the popular mayor, 21st July, 1792. In this capacity he welcomed the famous Marseillaise, who arrived eight days later in Paris, convoked by the fiery Barbaroux. A month later still, 13th August, Mayor Pétion conveyed the royal family in his carriage to their last home, the Temple Prison. But though in these things Pétion always took his share of the most disagreeable offices, coercing the mob on the one hand and the king on the other, he was a sincere and not unkindly, if a stern republican; and at the risk of his life he actually stopped the mysterious September massacres in the prisons in 1792, going from one prison to another in his tricolour sash of office. The carnage recommenced, it is true, as soon as he had gone away, but he nobly did what he could in that welter of anarchy. Pétion was elected to the National Convention in the same month, and declined his former post as mayor when re-elected. His continued popularity was shown in his occasionally serving as president of the Convention. He joined the famous party of the Girondins

or moderate republicans, and shared in their fate; possessed like all his comrades with a blind foolhardiness, he was found playing his violin on the very night of the fatal blow of the Jacobins. He was proscribed by the "Mountain," now the rulers of the Convention, on 31st March, 1793, but managed to escape to Bordeaux with the famous eleven, Barbaroux and others. In their perils it is admitted that he only once lost his presence of mind and evenness of temper. The fugitives had to separate, and long remained hid. Pétion went with Barbaroux and Buzot, and held out longer than almost all the rest; their last hiding-place was near St. Emilion, in July, 1794. One day as they were shifting their quarters they were alarmed by meeting a crowd. Barbaroux at once shot himself and fell dead, Buzot and Pétion fled away into the fields. The crowd was one of villagers only, but to the fugitives it seemed as if it were coming to drag them to the guillotine, which had already drank the blood of their companions. Two days afterwards Buzot and Pétion were found in a cornfield, where they had fallen from exhaustion, and their bodies were already half eaten by dogs.

PETITION (Lat. *petitio*). One of the fundamental principles of the British constitution is the right of a subject to petition the sovereign, or either House of Parliament, for redress of grievances. The right of petitioning was recognized indirectly as early as *MAGNA CARTA*, and directly at various later periods. Since the reign of William III. petitions have also been addressed to Parliament as expressions of public opinion on political questions. They must be in proper form, and respectful in language, and be presented by a member of the House to which they are addressed, except those from the corporations of London, Dublin, or Edinburgh, which may be presented by their respective lord mayors and lord provost. The petitions to the House of Commons are referred to the committee on public petitions, who examine and register them, and in some cases order them to be printed for the use of members. There are petitions extant of the date of Edward I., and they were presented in large numbers in the reign of Henry IV. From a parliamentary return it appears that in 1664 the number of petitions presented was twenty-one, in 1764 it was forty seven, and in 1864 the number amounted to 10,222. The two heaviest sessions were in 1843, when the enormous number of 33,898 petitions were presented, and in 1860, when there were 24,279. The committee invariably report to the House the cases of petitions that appear to them to be "fictitious." During the last forty years the committee have had before them nearly 500,000 petitions, of which they selected about 40,000 for printing. A member presenting a petition must confine himself to a statement of the parties from whom it comes, the number of signatures, the material allegations contained in it, and the prayer of the petition; the Speaker must not allow any debate on a petition unless it relates to a personal matter which requires immediate attention. No petition for a grant of public money can be received unless recommended by the crown.

PETITION OF RIGHT. In the first Parliament of Charles I., which met in 1626, the Commons refused to grant supplies until certain rights and privileges of the subject, which they alleged had been violated, should have been recognized by a legislative enactment. With this view they framed a petition to the king, in which, after reciting various statutes by which their rights and privileges were recognized, they pray "that no man be compelled to make or yield any gift, loan, benevolence, tax, or such-like charge, without common consent by Act of Parliament; that none be called upon to make answer for refusal so to do; that freemen be imprisoned or detained only by the law of the land, or by due process of law, and not by the king's special command, without any charge; that persons be not compelled to receive soldiers and mariners into their

houses against the laws and customs of the realm; that commissions for proceeding by martial law be revoked: all which they pray as their rights and liberties according to the laws and statutes of the realm."

To this petition the king at first sent an evasive answer: "The king willeth that right be done according to the laws and customs of the realm, and that the statutes be put in due execution, that his subjects may have no cause to complain of any wrongs or oppressions contrary to their just rights and liberties, to the preservation whereof he holds himself in conscience obliged as of his own prerogative." This answer being rejected as unsatisfactory, the king at last pronounced the formal words of unqualified assent, "Let right be done as it is desired." Notwithstanding this, however, the ministers of the crown caused the petition to be printed and circulated with the first insufficient answer. The petition was conceded on the 26th June, 1628.

PETITION, THE MILLENNARY. See MILLENNARY PETITION.

PETITIONS OF RIGHT. If the crown or a subject has a cause of action against a subject, the ordinary mode of proceeding in England is by the king's writ, requiring the party to appear in court to answer the complaint. If the claim is by a subject against the crown, the mode of proceeding provided by common law is to present a petition to the crown, praying for an inquiry and for the remedy to which the party conceives himself to be entitled. As by *Magna Carta* the king is not to delay right, he is bound, if the petition presents that which has the semblance of a legal or equitable claim, to indorse the petition with the words "Let right be done;" which indorsement operates, in the case of a claim of a legal nature, as a warrant and commission to inquire into the truth of the matters alleged in the petition. After the return to the commission the attorney-general pleads or demurs, and the merits of the case are then determined as in actions between subject and subject. The Petitions of Right Act, of 1860, allows petitions to be left with the secretary of state for the home department, for the king's consideration. If he thinks fit a fiat is issued that right be done, which fiat is served upon the solicitor to the Treasury, and a statement of defence is put in on behalf of the crown, and the case is tried like an ordinary action.

PETITIONERS AND ABHORRERS, party terms which arose in 1679 during the high fever of the elections for the Parliament of that year, when the king's (Charles II.'s) Roman Catholic proclivities were apparent, and when his childlessness, as regards legitimate offspring, made his avowed Catholic brother James the heir to the crown. The *Petitioners*, headed by the Duke of Monmouth, the very popular son (illegitimate) of the reigning king and an ultra-Protestant, "petitioned" for Parliament to sit; but Charles knew well that the first business would be an exclusion bill to keep James from the succession, and delayed the assembling of Parliament for a whole year after its election. The petitions which flowed in incessantly from all the country were full of appeals against "popery" and of the terrors of the famous "plot." The court party sent in counter-petitions expressing "abhorrence" of the disloyalty of those who sought to coerce the king as to the time of summoning Parliament, and hence were called *Abhorrers*. These latter were the direct ancestors of the Tory party, as the *Petitioners* were of the Whigs; and the terms Whig and Tory came into existence during 1680. Though the issues at stake soon became different, the main distinction as the court party and the people's party still continued.

PETITOT, JEAN, was born at Geneva in 1607. He was placed with M. Bordier, a jeweller, who employed him in preparing enamels for jewelry. In conjunction with Bordier he made several improvements in enamelling, and

applied the art to miniature painting. They came together to England, where Petitot was introduced to Charles I., who retained him in his service and gave him apartments in Whitehall. He painted several portraits in enamel of Charles and the royal family. On the death of the king, Petitot returned to France. Louis XIV. appointed him his painter in enamel, and granted him a pension and apartments in the Louvre. On the revocation of the Edict of Nantes he removed to Switzerland, where he died in 1691. He may be called the inventor of enamel painting, and was certainly the first who brought the art to perfection.

PETRA, about 80 miles from the Gulf of Akabah. Mount Seir sweeps far to the eastward, and again round to the westward, forming thus a large crescent. In the bosom of this crescent lies an assemblage of mountains and cliffs, to the whole of which the name Petra is often applied. Mount Hor is the highest summit, from which the eye wanders over a bare and desolate landscape, where mountain rises on mountain, cliff on cliff, all of which are composed of an old variegated sandstone, presenting in the lofty face of each towering cliff every colour that is possible for the painter to produce. In the middle of this vast ruin of an earlier world, inclosed in the arms of the fair and comparatively fertile Seir, natural agencies have hollowed out a deep and rugged basin, the only entrance to which is down a steep descent from Seir on the east, by a narrow chasm called Sik, 1 to 3 yards broad, and bounded by perpendicular rocky walls, 100 to 400 feet in height, but unconnected either with the Wadi Arabah or El-Ghor. Here lay the town of Petra, one of the most important towns in the north of Arabia, and the capital of the Nabathæi. It originally belonged to the Edomites, and was taken by Amaziah, king of Judah, who changed its name into that of *Joktheel* (2 Kings xiv. 7; compare Josephus, "Antiq." ix. 9, s. 1); but it seems in later times to have belonged to the Monbites, who called it *Sela* (Isaiah xvi. 1).

Petra is described by Strabo (xvi., p. 779) and Pliney ("Hist. Nat.," vi. 32) as situated on level ground about 2 miles in circumference, and surrounded by precipitous mountains. The town itself was well watered, but the surrounding country, and especially the part towards Judea, was a complete desert. The ruins still exist in the Wady Musa, on the east side of Mount Hor, two days' journey from the Dead Sea and the same distance north-east of Akabah. Nearly at the termination of a narrow valley extending for almost 2 miles, which formed the principal entrance to the town, there are the ruins of a magnificent temple and other buildings, entirely cut out of the rock. These remains were discovered by Burckhardt in 1812, in about 80° 15' N. lat. and 35° 35' E. lon. They have since been visited by numerous travellers and tourists. Among the most remarkable buildings, besides the temple, is a theatre, similarly excavated, with complete rows of benches capable of seating above 3000 spectators. All visitors mention with wonder and admiration the rich and variegated colouring of the rocks. The other notable ruins are those of the vast monolithic temple, called the Den or Convent; the Acropolis, or Citadel; and Kusr Farou, the so-called Pharaoh's Palace.

The valley is only 12 feet wide in some places, and almost dark, as the rocks on either side are nearly 800 feet high. The faces of the rocks are covered with cave tombs hewn out of the solid stone. Originally they were doubtless the abodes of the living—for the name *Horim*, applied to the original inhabitants, means "dwellers in caves;" but when the Nabathæi built the city in the little basin of the hills, the caves were doubtless abandoned as residences, and used as places of interment.

Petra was a flourishing emporium 1700 B.C., and a central point to which all the trade of Arabia, and much

of that of Egypt, Syria, and Palestine, tended. The impregnable nature of the site rendered it thus important. During the Crusades it was taken and retaken both by the Saracens and Christians. It afterwards fell into decay, and its very site was unknown to Europeans for several centuries.

PETRARCH (FRANCESCO) PETRARCA, one of the most renowned poets of Italy, was born at Arezzo in Tuscany, 20th July, 1304, and was found dead either of apoplexy or epilepsy, seated with his hand resting on a book in his library at Argua, 19th July, 1374. (The dates of both birth and death differ slightly in various records, and the circumstances of the death are diversely narrated.) In 1302, the year when Dante and many of the Bionchi faction were banished from Florence, Pietro (commonly called Petrarco or Petraccolo) da Parenzo, an adherent of the same party, went into exile; and with his wife Eletta (or Brigida) Canigiani, took up his abode at Arezzo, where their son Francesco di Petrarco or Petrarca was born. After various vicissitudes, the exile's hope of return died out; and about 1312 he and his family removed to Avignon, where under Clement V. the papal court held its state, and formed a centre of attraction to strangers from every quarter. Here and in the neighbouring town of Carpentras, Francesco cultivated grammar, dialectics, and rhetoric. His father subsequently sent him to Montpellier, and finally to the Bolognese University to study law as his profession; but the born poet pored far more willingly over Latin classics than over legal documents, and appears to have loathed a calling in which, as he deemed, he might secure success at the cost of conscience, but could scarcely hope to do so with clean hands. Petrarco's death put an end to the conflict between filial deference and strong inclination. Francesco abandoned the career selected for him; but perhaps made no wiser choice when, at the age of twenty-two, he, with his younger brother Gherardo, assumed the clerical habit, and found it constituted a passport into the corrupt intrigues of the court of Pope John XXII. In 1327 occurred the event which may be represented as the turning point of his life, which inspired so much of his Italian "Canzoniere," and of which the traces are discernible more or less openly in his correspondence and in other of his compositions. It is shrouded, however, with a veil of mystery, and the accounts of it irreconcilably differ. To follow one of the most popular narratives, the tale runs thus:—On Good Friday, 6th April, in the Church of St. Clara, in Avignon, Petrarca first beheld that incomparable golden haired Laura, who for precisely twenty-one years swayed, living, the current of his life; whose eyes and voice, habitual reserve, and exceptional piety inspired poem after poem; and from whose thrall not even the lady's death availed to release him. Her bare hand or dainty glove, her sweet speech or musical laugh, her tears, her paleness, her salutation, are noted with untiring minuteness. He records how he watched with rapture a young girl washing the veil of Laura; and on another occasion how he beheld a group of ladies with Laura in the midst, like the sun gilt by twelve stars. Between 1330 and 1331, in the endeavour, as some say, to alleviate his disastrous passion, Petrarca took sundry short journeys, which at any rate served to augment his love of Italy; and the accession in 1334 of Benedict XII. to the pontificate was followed by the first of those appeals, poetic and epistolary, which Petrarca addressed to popes and to temporal powers, urging the restitution of the papal court to Rome, and the deliverance of Italy. Late in 1336 Petrarca quitted Avignon, and early in the following year reached Rome, where he met with a warm reception from the Colonna family, and explored the antique monuments of the Eternal City; nor did he return to Avignon until the summer, soon again quitting it for the comparative solitude of Vaucluse, where he purchased a small house and estate, and found leisure

to compose many of his works, both in prose and in verse. In August, 1340, Petrarca received from the senate an invitation to Rome, there to be crowned poet-laureate; and on the self-same day a letter reached him from the chancellor of the University of Paris, proffering him the like honour in that capital. His own inclination and the advice of his friends made him prefer the former offer; and early in March, 1341, he arrived at the court of Robert, king of Naples and Jerusalem, to make before that most learned monarch of the period a solemn exhibition of his powers. For three days he discoursed publicly of poetry and science; after which the king formally certified his worthiness of the laurel, and deputed the poet Giovanni Barrili, one of his own courtiers, to represent the majesty of Naples at the ensuing ceremonial. On the following 8th of April, being Easter Day, Petrarca at the capital delivered an oration in honour of the muses; after which he was crowned with the laurel wreath, in presence of an approving concourse of the Roman people and of many dignified personages. In 1342 he was one of the ambassadors sent into France by the Roman senate and people to congratulate Pope Clement VI. on his assumption of the triple crown; and joined with him in this embassy was Niccolò Gabrino, better known by his historic name of Cola di Rienzi. The great Roman revolution effected by Rienzi in 1347 was hailed by Petrarca as the new birth of Italian liberty; and his letters and his verses were not spared to incite the tribune to further deeds. In 1348 a fearful pestilence ravaged Europe, and among its victims was Laura. The news reached Petrarca in Verona; and for some days afterwards he is described as scarcely breaking silence or eating except at the importunity of friends. In 1354 Petrarca was sent by Visconti of Milan to Venice, to treat of peace with the rival republic of Genoa, a thing often earnestly advocated by him previously, on his own authority merely, but though honourably received he was unsuccessful. In 1370 he retired to Arquà, a village in the Euganean Hills. His last public appearance occurred in 1373, when in the suite of Francesco Novello da Carrara he harangued the Venetian senate. On the first day, awed by his august auditory, and oppressed by old age and fatigue, he stood silent; but on the next performed his assigned part with great applause.

Petrarca left an illegitimate daughter, Francesca, sometimes called Tullia, married to Francesco da Brossano of Milan. To this couple he bequeathed his property, after leaving legacies to various friends and domestics; and a gift of books which he had made to Venice in 1362 formed the nucleus of the world-renowned library of St. Mark. Boccaccio, a warm admirer of Petrarca, describes him as tall and handsome, round-faced, grave and mild of aspect, with eyes at once gladsome and penetrating, and a merry but not undignified laugh; placid and joyous of speech, though seldom speaking except in answer, and then weightily; in dress conformable to custom; in music a lover not merely of the human voice and instrumentation, but also of the song of birds; patient, or if angered beyond reason, soon recollecting himself; truthful, very faithful; in religion eminently Christian, though harassed (as Petrarca himself confesses) by temptations of the flesh. Elsewhere we read of his systematic fasts, his masses put up for the soul of Laura, his social habits, contempt of riches, and pious practices. Besides the works already particularized in the course of this article, Petrarca has left many others, including a Latin poem, "Africa," and several biographical,

political, philosophical, and religious works; a Syrian Itinerary, composed, as has been suggested, for the use of Giovanni di Mandello, sometime podestà of Piacenza; Epistles, both in prose and in verse; and certain Latin Eclogues or Bucolics, avowedly allegorical.

PETREL is the name of a group of sea-birds forming the family Procellariidæ, and usually placed near the Laridæ (gulls and terns) in the order Anseres. Mr. Forbes, however ("Challenger" Report, "Zoology," vol. iv., Part 11), regards the petrels as forming a distinct order, Tubinæ, composed of two families, Procellariidæ and Oceanitidæ.

In the petrels the upper mandible, which is furrowed into distinct segments, terminates in an abruptly hooked nail, and the under mandible also terminates in a sort of hard distinct nail. The nostrils are more or less decidedly tubular, and sometimes the tubes are united together. The anterior toes are webbed; the hind toe is either wanting or rudimentary. Their flight is very buoyant. Many species eject a considerable quantity of oil from the nostrils, either from fear or by way of defence. Their bodies are saturated with oil, from the nature of the food on which they subsist, namely, blubber, fishes, molluscs, and crustaceans. They never resort to land, except for breeding purposes.

The best known of the petrels is the Stormy Petrel (*Procellaria pelagica*), the "Mother Carey's Chicken" of



The Stormy Petrel (*Procellaria pelagica*).

English sailors. The stormy petrel is common in most parts of the Atlantic and Mediterranean; it breeds on some of the Channel Isles, also on some of the islets off the coast of Wales, and probably on Lundy Island; it also breeds on many of the islands off the west coast of Scotland and in the Orkneys and Shetlands, and off several islands in Ireland. This graceful little bird is less than 6 inches in length. Its general colour is sooty black, with the outer edges of the wing-coverts grayish-white, the upper tail-coverts white tipped with black, and the sides of the vent white. The stormy petrel wanders all over the Atlantic Ocean, depending, however, upon its long, pointed, and powerful wings for its rapid movements from place to place. Even in stormy weather the petrels, notwithstanding their small size, are very active, flying along over the surface of the waves, with their feet close to, or dipping in the water; indeed, the sailors believe that it is principally at the approach of a storm that these birds make their appearance, and they are known among mariners by the names of Devil's Birds and Mother Carey's Chickens. The name "petrel" is supposed to be a diminutive of Peter, and to be given to the birds in allusion to their apparently

walking on the surface of the water, as the apostle did on the Lake of Genesareth. The food of the petrel consists of small fishes, crustaceans, molluscs, and other marine animals, and they will also follow ships for considerable distances in order to pick up any fragments of food that may be thrown overboard. This bird breeds among the stones and debris of rocks on our coasts, generally on small islands, and the female lays only a single egg, upon which she sits so closely that she may readily be taken by hand; when thus treated she vomits a quantity of oil, which is collected for burning in many places.

The Giant Petrel (*Ossi-fraga gigantea*) is common in the Southern Ocean, and is sometimes seen on the Pacific coast of North America in spring and summer. It is nearly 3 feet in length, blackish gray above and paler gray beneath, with the head and neck dirty white. The Pintado Petrel or Cape Pigeon (*Daption capensis*) is also abundant in the Southern Ocean; it is about 13 inches in length, and has its upper surface speckled with black and white, and the lower parts white. Wilson's Petrel (*Oceanites oceanica*) is common both in the South and North Atlantic, and several specimens have been taken in England.

Many other species of this family are known, several of which are described elsewhere, as ALBATROSS (*Diomedea*), FULMAR (*Fulmarus*), SHEARWATER (*Puffinus*).

PETRIFICATION (lat. *petra*, stone; *facio*, to make) is a term commonly employed in two ways. It is sometimes used as synonymous with FOSSILIZATION, the process by which organic bodies are mineralized and preserved in rocks; and sometimes it has a less accurate use. It is well known that when water containing abundance of carbonate of lime in solution is exposed to the air and allowed to evaporate, or to give off carbonic acid, a deposition of the calcareous matter takes place. In limestone districts, for example, such deposits are often formed in the beds of the stream, at the outlets of springs, and on the roofs and floors of caverns. This chemical phenomenon is usually taken advantage of when any considerable springs rise to the surface—as in Derbyshire—for the production of ornaments, by allowing various articles to become incrustated with the lime through the constant drip of the water upon them. These are commonly sold as “petrifications,” and the spots where they are produced are exhibited as “petrifying wells.” It is obvious, however, that in these cases the original body remains unchanged, and is merely incrustated with a film of the stony material.

PETROICA is an Australian genus of Passerine birds belonging to the family Sylviidae or warblers. The species of this genus are known to the colonists under the familiar name of robins. The Scarlet-breasted Robin (*Petroica multicolor*), abundant in South Australia, resembles our English redbreast somewhat, but his song is weaker and his plumage more brilliant. The male has his upper surface jet black, the forehead and some bands on the wings white, and the breast bright scarlet; the female is pale-brown, with the breast red. The total length is about 5 inches. The nest is placed usually in the hollow of a tree, and contains three or four eggs. Several other species of robins are found in Australia and Tasmania.

PETROLEUM, ROCK OIL, or NATURAL NAPHTHA is a mineral fluid of a highly combustible nature, belonging, in a chemical point of view, to the hydrocarbons, though contaminated to a greater or less extent with other substances. It is almost entirely volatile, and is generally black, with a greenish line and somewhat offensive odour. Some varieties are nearly colourless. Its specific gravity ranges from 0.782 to 0.927 or upwards. The products obtained from crude petroleum on rectification vary in different localities. Among the principal are, an oil suitable for burning, the yield of which is from 38 to 90 per cent.; a kind of naphtha, improperly called benzole, and used as a substitute for oil of turpentine, ranging from

5 to 20 per cent.; a heavy oil suitable for lubricating machinery, besides solid paraffin and pitch. The separation and purification of these articles is now an important branch of industrial chemistry.

Petroleum is found in many parts of the world. The oldest known sources are those of Baku, on the borders of the Caspian. Here it is obtained nearly colourless, and can be burned in lamps without any preparatory purification. The wells of Yunnanlung, near Rangoon, on the Irawaddy, yield a large supply of excellent petroleum, containing from 10 to 11 per cent. of paraffin. Petroleum is also found in New Zealand, Australia, Java, Sumatra, Hanover, Galicia, Italy, Sicily, Switzerland, France, and Bavaria. The chief supply of petroleum is, however, at present obtained from the western continent. Most of the West Indian Islands contain petroleum and bitumen, especially Trinidad, Barbadoes, and Cuba. It is also found in Brazil, Venezuela, at Maracuyho, and in various other parts of South America. Within the last few years the United States have furnished a larger supply of petroleum than all the rest of the world. In the state of New York it was known to the aborigines, and was long collected for medicinal purposes under the name of “Seneca oil.” In 1860, however, a method of distilling and refining it was discovered, by which it could be sold for burning for lighting purposes at a lower price than the schist-oils, and it is from that time that the gigantic development of the trade commenced. Pennsylvania is now the chief oil district, but Ohio, Western Virginia, and Kentucky are also large producers. Tennessee, Georgia, Alabama, Missouri, Texas, Arkansas, Illinois, Indiana, and Michigan are all known to contain this oil, and California is capable of yielding an enormous quantity.

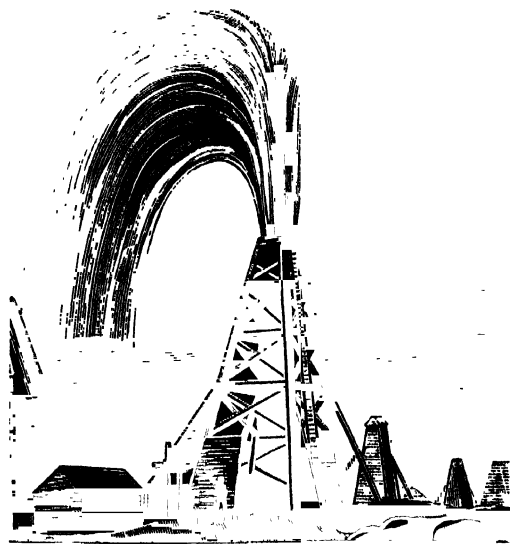
The petroleum occurs at various depths beneath the surface, is very uncertain in the duration of supply, and only a few specimens are free from admixture with water. When once a market had been found for the produce the trade grew in a manner unexampled even in America. A small amount of capital brought a large and rapid return; adventurers rushed in from all quarters; and a somewhat sterile and desolate region became a series of rough but populous towns. Oil is found throughout an area of 2000 square miles; but the richest supply is obtained from a small area in the western part of the state of Pennsylvania. By the year 1865 “Petrolia,” a fanciful name for the oil region, could boast of Oil City, Pithole City, Corry, Rouseville, Plummer, Titusville, &c., each with its banks, newspapers, hotels, and theatres. Oil City was nearly destroyed by fire in 1868, through the ignition of some of the petroleum. The British consul at Philadelphia, in his annual report published in 1878, asserted that the productive capacity of the oil region might be said to equal anything that a profitable trade would warrant; and the duration of the supply might be inferred from the fact that the process of formation of the oil was always going on in the bosom of the earth, so that there were said to be oil wells in Asia that have been flowing for 2000 years! Against this, however, is to be placed the fact that in Pennsylvania few wells yield for more than three years, and that those in the northern part of the state have for some time past been pumped dry. It was soon found of advantage to distil the oil at the place where it is produced; for while in its crude state petroleum is combustible, explosive, and dangerous, the best refined sorts are safe for transport or domestic use; and America now exports only a very small quantity of the raw material. Indeed, nothing has tended so much to increase the trade as the construction of these extensive refineries.

The first shipments of petroleum from America to Great Britain were forwarded in 1861, when the total was only 360,000 gallons. In 1880 the total shipments of petroleum from America to all parts of the world were 378,310,000 gallons. This included about 40,000 barrels of Canadian

oil. The shipment in 1880 (378,310,000 gallons) was the largest quantity shipped in one year. The quantity produced in the United States in 1884 was 24,019,758 barrels.

A similar, though less prolific, oil region has been discovered in Canada; but the trade has not been so energetically developed as in the United States. Much of the oil produced is of a very fine quality, and can with difficulty be distinguished from that produced in Pennsylvania.

Another large oil region has recently risen to great importance, that of Baku, on the Caspian, where Messrs. Nobel have established refineries capable of turning out 65,000,000 gallons of lighting oil per annum. This Russian oil is very fine, and has a high illuminating power; it is becoming a serious rival to that of America. The Russian output of crude petroleum for 1884 amounted to 1,130,000 tons; that of America for the same year was about 3,000,000 tons. The petroleum is estimated to underlie about 14,000 square miles in the vicinity of Baku, and some idea may be formed of the quantity produced by a single boring in this district by the accompanying illustration. It represents



the column of crude petroleum rising from one of Messrs. Nobel's borings. In this well the column of oil is a foot in diameter, and rises to a height of 140 feet. One of these wells yields 1,125,000 gallons of oil in twenty-four hours; in another the pressure of the oil was 200 lbs. on the square inch, and the height of the column 250 feet. Another well was for four months quite uncontrollable, and during that time ejected above 100,000,000 gallons of oil, worth over £1,000,000 sterling, all of which was lost from the impossibility of collecting and storing it.

In order to refine the petroleum it is distilled in an ordinary iron still. The distilled oil is then purified by treating it with oil of vitriol and then with caustic soda. During these operations the mixture is powerfully worked together for a long time by means of a sort of battledore moved by steam. Thus is obtained a beautiful colourless fluid, which acquires a slightly opal tint under reflected rays of light. Before sending this out into the market it is submitted in the workshop to the "trial by fire;" in other words, the makers assure themselves that when warmed to a degree of heat required by law it emits no in-

flammable vapour. For this purpose the bulb of a thermometer is plunged into a porcelain or glass vessel containing the oil, under which a small spirit lamp is lighted. As soon as the thermometer marks that the temperature has reached the limit—that of 110° Fahr.—a light is passed over the surface of the liquid; if it have allowed any vapour to escape this immediately takes fire, in which case the oil is submitted to another distillation.

American petroleum consists almost entirely of hydrocarbons of the methane or C_nH_{2n+2} series. [See PARAFFIN OIL.] Russian petroleum contains benzene, but consists chiefly of hydrocarbons of the C_nH_n series. The following have been separated from it:—

	Boiling point.	Specific gravity.
C_8H_{18}	119° C. or 246° Fahr.	... 771
C_9H_{20}	136 " 276 "	... 780
$C_{10}H_{22}$	161 " 321 "	... 795
$C_{11}H_{24}$	180 " 356 "	... 811
$C_{12}H_{26}$	196 " 384 "	... 822
$C_{14}H_{30}$	210 " 410 "	... 819
$C_{16}H_{34}$	217 " 422 "	... 829

Crude petroleum has been used in America for the production of a gas which is found to have a much higher illuminating power than coal gas. It has been tried also as fuel for steam engines, and is largely used for this purpose in the Caspian steamers.

Concerning the origin of petroleum geological theorists and chemists are not agreed. The prevailing view is, that it has been distilled by subterranean heat from the beds of coal, leaving a residue of anthracite. If we bear in mind, however, the different geological features of the petroleum districts, and the variation in the properties and constitution of the oil itself, we can scarcely admit that the mode of its production has been everywhere uniform. Professor Hitchcock points out that it cannot be merely the result of a natural distillation of coal, seeing that its chemical composition is different from the paraffins or camel-coal oils, in containing neither aniline nor nitro-benzole. Moreover, he adds, petroleum occupied fissures in the Silurian and Devonian strata of America long before the trees of the coal period were growing in their native forests. Dr. Sterry Hunt, F.R.S., of Montreal, says there are certain limestones so largely oleiferous in the United States that it seems to be unphilosophical to search elsewhere for the origin of the oil. In the neighbourhood of Chicago there are enormous deposits of this oil-bearing limestone; and in a very able article in *Fraser's Magazine*, October, 1875, Professor Owen, after describing the very interesting processes of procuring and conveying the "crude oil," pointed out numerous other districts in which petroleum had been or may be expected to be found.

The main supply of petroleum is obtained from wells bored for the purpose. Some of these have for a short period yielded 40,000 gallons daily, and even greater amounts; but the average daily yield of a well is not above 200 gallons. From some of the wells the oil is raised by means of pumps, while from others it issues in a fountain. In the sandstone beds there are large cavities filled with water, petroleum, and gas; and when these are penetrated by the boring tools the contents escape with violence until exhausted.

Many fearful disasters have taken place both in America and England through the conveyance and incautious use of petroleum—the worst in this country having been the fearful railway catastrophe at Abergele on 20th August, 1868, when thirty-three persons were burnt to undistinguishable cinders.

In consequence of the inflammable nature of the commoner kinds of petroleum, several Acts of Parliament have been enacted to regulate its storage and use. The last, passed in 1871, provides that no petroleum shall be kept, except

for private use, within 50 yards of a dwelling-house or a building in which goods are stored, except in pursuance of a special license on the subject; and no person shall sell any description of petroleum which gives off an inflammable vapour at a temperature of less than 100 degrees, unless the bottle containing it has a label stating that "great care must be taken in bringing any light near the contents of this vessel." Licenses must be granted for the sale of petroleum; search may be made for it by officers appointed for the purpose, and it may be seized if not properly kept.

Special ships are used in the trade, and warehouses have been built solely for its reception at the docks, both in Liverpool and London, in consequence of the high premiums charged by insurance offices if it is stored with other goods.

PETROLOGY (Gr. *petra*, rock; *logos*, discourse) is that branch of geological and mineralogical science which treats of the structure and mode of origin of rocks. In its widest sense it is concerned not only with the arrangement of the rock masses as they occur in the field, but also with their minute structure and composition; some writers, indeed, distinguish the latter study under the name of **LITHOLOGY** (Gr. *lithos*, stone; *logos*, discourse), and define petrology as referring only to the first-mentioned point; but opinions on this subject are very varied, and it seems the most usual custom to regard the one term as merely synonymous with the other.

Until 1858 the only means of distinguishing one variety of rock from another consisted in chemical analysis, relative hardness, and the examination of broken surfaces with a lens. In that year, however, Dr. H. C. Sorby read an important memoir before the Geological Society of London, in which he described the interesting results to be obtained by making thin sections of rock-fragments, and studying these under the microscope. At the present day it is not considered possible to understand the nature of a rock without examining transparent slices by the various optical means afforded by the modern microscope, and the other methods of investigation appear only more or less subsidiary to this.

One of the most interesting achievements of the later researches, is the discovery of the precise relationships of one species of igneous rock to another. It has long been known that the texture of a once molten mass depends upon the circumstances under which it has cooled—whether rapidly or slowly, whether at the surface or under great pressure: the most crystalline masses are those that have cooled most slowly at the greatest depths, and the most glassy rocks are those that have rapidly hardened on exposure to the atmosphere. It is therefore obvious that any molten mass of a given chemical composition is capable of producing several kinds of rock, the amount of crystallization and the relative development of its mineral constituents depending upon the conditions of cooling at each spot. In this manner it has been discovered that a single "magma"—as a molten reservoir of approximately uniform composition is technically termed—may consolidate into **GRANITE** beneath a volcano, into various kinds of **PORPHYRY** in the pipe of the volcano, and into a **RHYOLITE** lava, with layers of glassy **OBSIDIAN**, at the surface. Similarly, a crystalline **GABBRO** graduates by porphyries into **BASALT**, this again occasionally showing glassy surfaces of tachylite. The first four figures of magnified rock sections in **GEOLOGY**, Plate I. vol. vi., well exhibit some of these stages. Fig. 1 shows glassy obsidian with a number of parallel but indefinite crystalline needles; fig. 2 is a section of pitchstone, which shows these incipient crystallites or microliths grouped together in arborescent forms; fig. 3 exhibits well-defined crystals scattered through the glass substance with microliths, in basalt; and fig. 4 represents a section of granite, which is wholly crystalline, showing not a trace of glassy material.

The object of the petrological classification of igneous

rocks is thus to determine the various species resulting from the cooling of each particular magma, and to explain their relation one to another, by discovering the different circumstances under which they have cooled and consolidated. Professor T. G. Bonney (in Browne's "Handbook of Physical Geology," 1884) recognizes about seven main groups, and all comprise both crystalline, semicrystalline, and glassy members.

Another interesting result of the work of Dr. Sorby and those who have followed him, is the discovery of minute cavities in the crystals of rocks, some of these containing water, others liquefied carbonic acid, &c., and others filled with glass-substance, or extremely minute crystals. They point to the existence of enormous pressure at the time of solidification, and Dr. Sorby estimates that, if this took place at a temperature not exceeding 680° Fahr., many of our British granitic rocks cannot have originated under less compression than would be brought about by a superincumbent series of strata of 50,000 to 70,000 feet in thickness.

One other great problem upon which petrological inquiries have been made to shed light, is the question of the former existence of a continent in the area at present covered by the Atlantic Ocean. The Reports of the *Challenger* expedition record how M. Renard of Brussels has submitted some specimens of rock from the St. Paul's Islets to microscopical and chemical examination; and the results are generally believed to show that these oceanic islands are simply due to volcanic agency, and are not the mountain peaks of a submerged continental land.

Modern petrology, therefore, is connected with generalizations of the grandest extent, notwithstanding the apparently insignificant minutiae with which it is largely concerned; but it must be distinctly remembered that while these laboratory methods are all important in the present state of research, they only supplement—by no means supplant—most careful observations in the field, of such great rock features as have already been detailed in the article **GEOLOGY**.

(F. Rutley, "Study of Rocks," Longmans, 1879; A. Geikie, "Text-book of Geology," second edition, Macmillan, 1885; J. J. H. Teall, "British Petrography," Watson & Douglas, Birmingham, 1886.)

PETROMY ZON. See **LAMPREY**.

PETRONIUS ARBITER, author of a celebrated Latin work named "Satyricon." From the work itself nothing is discoverable as to its author; but the second name, "Arbiter," evidently shows that the ancients referred it to the notorious Caius Petronius Arbiter, acknowledged chief of Roman dandies, one of the voluptuous courtiers of Nero. From that emperor he received the title of "arbiter elegantiarum," or director-in-chief of the imperial pleasures and amusements. Being a person of much talent and ingenuity, he aroused the jealousy of Tigellinus, the infamous minister of Nero, who accused him of participating in the conspiracy of Sejanus and Piso. Petronius avoided the cruelty of the emperor by a voluntary death at Cumæ, 66 A.D. The "Satyricon" consists of a prose narrative, interspersed with numerous pieces of poetry, thus resembling in form the ancient Roman satire. It is a sort of comic romance, written with abundance of wit and cleverness, and throwing much light on the manners and usages of the Romans under the emperors. Petronius is ranked by Niebuhr as the greatest poetical genius that Roman literature can boast of after the time of Augustus, but this opinion is certainly too favourable.

PETROPAULOVSK, a town and fortress of Russian Siberia, in the province of Akmolinsk, 255 miles south by east of Tobolsk, on the Ishim. It is an important military post, and carries on an extensive trade, being a station for the caravans from Bokhara, Khiva, and the country of the Kirghiz.

PETROPOLIS, a town of Brazil, in the province of, and 40 miles inland from, Rio de Janeiro, in the Organ Mountains, 2600 feet above the sea, was originally a German colony, but has been adopted, from its healthy climate and superb scenery, as the summer residence of the Emperor of Brazil, and the resort of the "corps diplomatique."

PETROSILEX (Lat. *petra*, rock; *silex*, flint) is a compact flinty rock, allied to hornstone, and belonging to the **FELSITE** group of geologists. It consists essentially of a micro-crystalline aggregation of quartz and felspar.

PETRUCI, OTTAVIANO DE', the first music printer of importance, was born at Fossombrone in 1466, and died there about 1525. His best work was done in Venice, and is sufficiently described in the article **PRINTING** (section *Music Printing*).

PETTY OFFICERS, in the navy, are analogous to non-commissioned officers in the army. They are the upper class of seamen, and are responsible for the proper care of the several parts of the ship.

PETTY SESSIONS. Where two justices are empowered to try in a summary way and without jury such minor offences as are left to their decision by different statutes, the meeting of such two or more justices for this purpose is denominated a *petty session*. Unless where excluded by statute, an appeal from petty sessions may be made to quarter sessions.

PETTYCHAPS. See **BECCAFICO**.

PETUNIA (Brazilian, *petun*, tobacco) is a genus of plants, closely allied to the tobacco plant, of the order **SOLANACEÆ**, which is now much cultivated in gardens for the sake of its handsome funnel-shaped or salver-shaped flowers. These are either plain, variegated, or striped, the colours being white and purple. Numerous varieties and hybrids have been formed from one or two wild South American species. In some varieties the flowers are scented. Double flowers are also common. In one variety the stamens are frequently replaced by green leaves. The petunia grows well if trained over a trellis, or it may be treated as an annual, and planted out in summer. Its leaves are slightly viscid, and emit a disagreeable odour. It was introduced into England in 1825.

PETWORTH MARBLE, a limestone occurring in the Wealden beds of Sussex, and almost entirely composed of the shells of a species of *Paludina*. It is also known as the *Sussex Marble*, and is largely used for architectural purposes.

PEUCE'DANUM is a genus of plants belonging to the order **UMBELLIFERÆ**. The species are numerous, distributed in tropical and temperate regions. They are perennial herbs with white, yellow, or pink flowers in compound umbels. *Peucedanum officinale* (sulphur-wort, or hog's funnel) is found in marshy and shady places throughout Europe. In England it is rather rare, occurring in Kent, Essex, and the Channel Islands in salt marshes. The flowers are yellow and minute. The juice of the root of this plant is resinous and has a strong sulphurous smell. *Peucedanum palustre* (milk parsley) occurs locally in many parts of England. It has minute white flowers. The root yields a yellow foetid gum-resin.

PEUTINGERIAN TABLE is the name given to a map (21 feet in length and about 1 foot wide) of the roads of the ancient Roman world, made, as some suppose, in the third century of the Christian era; but this is hardly more than a conjecture. It is on parchment, and was found in a library at Speyer in the fifteenth century. It was bequeathed by the proprietor Conrad Celtes to his friend Conrad Peutinger (whence its name), a learned man of Augsburg, who died in 1547.

PEVENSEY, the Roman *Anderida*, and one of the Cinque Ports, is a small village, formerly a harbour of England, in the county of Sussex, 16 miles south-east by east from Lewes, and 65 from London by the South Coast

Railway. The port was important in the Saxon and Norman times, but the sea gradually retired, and it is now filled up. Pevensy Bay, however, still affords good shelter for shipping. There are ruins of Pevensy Castle, which seem to have been built with some of the remains of a Roman fortress. It was founded by Robert de Moriton, the Conqueror's half-brother. The principal baubican or watch-tower is not at the entrance, but towards the north-east corner. The walls are 9 feet thick, and the towers were two and three storeys in height. The castle was of great strength. It was besieged by William Rufus in 1088, by Stephen, by the younger Simon de Montfort, and was the prison of Joan of Navarre, widow of the Emperor Henry IV. Pevensy church is Early English. The bay is reputed to have been the scene of Julius Caesar's landing, as well as of William the Conqueror's. Population of the village, 365.

PEW (Lat. *podium*, a balcony or gallery; Dut. *puze*). The word pew seldom occurs in writers upon ecclesiastical law, who almost invariably use the expression "church seat."

There were no pews in churches until about the period of the Reformation, prior to which the seats were movable, such as chairs and benches, as we see at this time in the Roman Catholic churches on the Continent. A parishioner has a right to a seat in the church without any payment for it. But private rights to pews may be sustained upon the ground of a faculty, or of prescription, which presumes a faculty.

The purchasing or renting of pews in churches is contrary to the general ecclesiastical law. Pew rents, under the Church building Acts, are exceptions to the general law; and where rents are taken in populous places, they are sanctioned by special Acts of Parliament. Pew rents in private unconsecrated chapels do not fall under the same principle, such chapels being private property.

PEWTER (Old French, *peutze*; Dutch, *peauter*), an alloy of tin and lead, intermediate in hardness between the latter and Britannia metal. The proportion of the metals used in the manufacture is varied to suit different purposes, but the following are the standard formulas:—For common or *ley-pewter*, 4 parts of tin and 1 part of lead; for *plate-pewter*, 100 parts of tin, 8 parts of antimony, and 2 parts each of bismuth and copper; and for *triple-pewter*, 83 parts of tin and 17 parts of antimony. Lead in small or large proportions is often added to the last two kinds.

PEYER'S PATCHES. See **INTESTINE**.

PEZIZA is a genus of fungi belonging to the group **DISCOMYCETES**, and nearly allied to the edible **MORILL**. The species present great variety as regards size, colour, &c. They are found on a number of vegetable substances or on the ground, and a few inhabit the dung of animals. Some of the larger species, as *Peziza eschscholii*, are edible. Some are most brilliantly coloured, as *Peziza aurantia*, which is a brilliant orange, and grows about the stumps of old felled oaks; and *Peziza coccinea*, a stalked form growing on dead sticks, which is white outside and scarlet within. In *Peziza* the receptacle is saucer-shaped, with the hymenium (spore-bearing surface) lining the upper side.

PFÄFERS or **PFEFFERS**, a town of Switzerland, in the canton of St. Gall, about 8 miles from Ragatz, celebrated for its thermal vapour baths, which are impregnated with carbonate of lime, chloride of sodium, and magnesia, and situated on the west side of the Tamina, in so deep a ravine that even in July and August the sun has access to them for only four hours in the day.

PFAHLBAUTEN (Ger., pile-dwellings), a term originally applied by Swiss archaeologists to the structures more commonly known as **LAKE-DWELLINGS**.

PFENNIG, a German copper coin, is, as far as the word goes, identical with our word **PENNY**, both of them coming from *pfund* or *pawn*, a token of value. The

German pfennig, however, was always much smaller than the English. The old pfennig of North Germany was worth nominally a twelfth of a silver grochen—that is, 360 would go to the thaler—and in actual metal held about $\frac{3}{16}$ of the old English copper penny. In the South German states the pfennig was worth just the twelfth of a penny. There were also other pfennige.

All these are now almost entirely superseded by the new imperial coinage, wherein the Reichs-pfennig is the hundredth part of the Reichsmark, worth (in gold) $11\frac{1}{2}$ d. sterling, or very closely our shilling. For practical purposes, therefore, a pfennig may be taken as worth a trifle less than half a farthing.

PHÆDRUS (Gr. *Phaidros*), a Latin writer of the Augustan age, appears to have been by birth a Greek, a native of Thrace, whence he was brought to Rome as a slave. He is said to have been emancipated by Augustus Caesar. In the reign of Tiberius he underwent some persecution at the hands of Sejanus. His works, exclusive of thirty two fables considered spurious by eminent scholars, consist of ninety-seven fables, written in iambic verse, and divided into five books. Their subjects, we are told—and Bentley strongly advocates the opinion—are mainly borrowed from Æsop and Babrius, to the latter of whom Phædrus is especially indebted. But the fabulist deserves credit for the elegant diction, sound morality, and pointedness of humour which he has displayed in their transference from the Greek originals. The "Fables" were edited by Bentley, and appended to his edition of Terence. The best edition of them which has been published is by J. C. Orelli (Zurich, 8vo, 1832).

PHÆDRUS, PHÆDRA. See PHAIDROS, PHAIDRA. **PHÆORETIN**, a resinous substance obtained from rhubarb root. It is a yellowish-brown powder, insoluble in water, but soluble in alcohol and in alkalies, also in acetic and sulphuric acids. The alkaline solution is of a deep reddish-brown colour, and from this solution phæoretin is deposited as a yellow precipitate by any mineral acid. With acetate of lead it forms a violet precipitate. The formula is $C_{10}H_8O_2$.

PHAETHON (Gr. *Phaithon*, the shining one), in the Greek mythology, was the son of Hélios the sun-god by the Oceanid nymph Klamiñe, and was called Phaithon on account of his splendid parentage. He begged his father so earnestly to allow him to drive the horses of the sun across heaven, that the over-fond parent was weak enough to consent. But as soon as the horses felt the mortal hand behind them they began to plunge, the chariot of the sun swerved from the track, and swiftly fell so near the earth as to scorch large tracts of it into the well-known deserts. In a few moments the whole world would have been in flames as the maddened horses rushed this way and that, had not Zeus launched a swift thunderbolt at the imprudent charioteer, and hurled him headlong into the river Eridanos (probably the Po). The poplars which lined the shores of Eridanos were held to be the shuddering weeping bodies of the sisters of Phaithon (the Heliadæ), who refused to move from the banks till the gods in mercy transformed them; and the amber found in the river sands was fabled to be their tears thus crystallized and preserved. The river, as a memorial, was set among the stars as a constellation. See ERIDANUS.

PHAIDRA (Lat. *Phædra*), daughter of Minos, king of Crete, the faithless wife of the great hero Theseus in the Greek mythology, who by her false accusation against her stepson Hippolitus brought about his terrible death through the curses of his incensed father. The story is a classical parallel to the Hebrew legend of Potiphar's wife, though as usual the Greek story has a lamentable end. Nor did the fate of Hippolitus stand alone; overwhelmed by the consciousness of her crime Phaidra hung herself within the palace.

PHAIDROS (Lat. *Phædrus*), the head of the Epicurean school when Cicero went to study at Athens in B.C. 80. He died ten years later. His great work "Perrithon" ("On the Gods") was long considered to be lost, but an extensive fragment of it was unearthed in the ruins of Herculaneum in 1806 (Peterson, Hamburg, 1833); and proved, as was known from other evidence before, that it was chiefly from this philosopher that Cicero drew his opinions, especially those forming the basis of his celebrated treatise "De Naturâ Deorum" ("Concerning the Nature of the Gods").

PHALÆNOPSIS is a genus of plants belonging to the order ORCHIDÆÆ. The species are very beautiful orchids, natives of the Malay Archipelago. They are epiphytes, with the stem hardly developed, and a few broad leathery or fleshy leaves and numerous large flowers disposed in racemes. The best known species, and the first introduced into Europe, is *Phalænopsis amabilis*, from Manila, which has the flowers pure white, except the small lip, which is streaked and spotted with yellow and crimson. Another species esteemed in cultivation for its beauty is *Phalænopsis Schilleriana*.

PHALANGER (Phalangisturæ) is a subfamily of MARSUPIALIA, forming with the KOALA (Phascogaleto-) the family Phalangistidae. The phalangers, like the vast majority of the marsupials, are entirely confined to the Australian region, but one genus (*Cuscus*) is found as far west as Celebes. The phalangers are small animals with a woolly fur, the hind and fore feet about equal in length, the claws large, the great toes without nails and opposable to the rest, and the tail long, and in many species prehensile. The dentition in the molar series is variable, but the incisors are three above and one below, and the canines one above and below on each side, the lower canines being small. The stomach is simple and the cæcum long. All the phalangers are nocturnal and arboreal in their habits, feeding on fruits and leaves, and occasionally on small birds. About thirty-five species are known.

The Vulpine Phalanger (*Phalangista vulpæcula*) is very common in Australia, taking up its abode especially in the Eucalypti or gum-trees. It is somewhat fox-like in appearance, but is about the size of a cat. The general colour is brownish-gray, the under parts being whitish, the ears white, and the tail, which is not prehensile, black. It is much hunted by the natives, who are very fond of its flesh. A closely allied species, the Brown Phalanger (*Phalangista fuliginosa*), takes its place in Tasmania. The Spotted Phalanger (*Cuscus maculata*), found in New Guinea, belongs to the genus *Cuscus*, which is distinguished by having a naked prehensile tail. There are eight species of this genus, ranging from Celebes through the islands of the Australian region to North Queensland. The Dormouse Phalangers (*Dromicia*) are very pretty little animals, very like dormice, except for their prehensile tails; they are found in New Guinea, Australia, and Tasmania. The FLYING PHALANGERS (*Petaurus* and *Acrobata*) are distinguished by the possession of a membranous expansion of the skin of the body between the fore and hind legs, which supports them in the air when making long leaps.

PHALANGIDÆÆ. See HARVEST SPIDERS.

PHALANX (Gr. *Phalagx*), in military science, a close and compact order of battle, in which heavily armed troops are drawn up in a line of parallel columns four to eight men deep. It was originally introduced into the Lacedæmonian army, but was afterwards adopted and modified by various states. Philip of Macedon, when meditating the subjugation of Greece, devised the famous Macedonian phalanx (B.C. 359), which enabled his son Alexander to march triumphant from the Ægean to the Indus. The line was sixteen men deep. Four phalanxes formed a grand phalanx, which mastered 16,384 *hoplites* or heavily armed soldiers, and was divided into eight

brigades or *merarchies*, each containing two *chiliarchies* or regiments, and each regiment into four battalions or *syntagmata*. Each soldier was armed with a short sword, a buckler, and a two-handed spear 21 feet long, of which 6 feet were behind and 15 feet in front of the warrior, so that as each rank occupied 3 feet there extended in front of the phalanx a glittering fivefold rampart of steel. The ranks behind the first five slanted their spears over the shoulders of their comrades in front, forming a shield against arrows, darts, &c. But the defect of this formation was its unwieldiness, and when exposed to the lighter and more mobile Roman legion it was invariably defeated; but for Philip's purposes, to contend against the one-handed short spears of Grecian hoplites, it was perfect.

PHALARIS, a tyrant of Agriguntum in Sicily, B.C. 570, infamous for his cruelty, and especially for the particular device, which he owned to Perillos, of roasting his victims in a bull of bronze, in order that he might enjoy the pleasure of hearing their cries. He is said to have burnt Perillos first in his own bull.

Certain epistles in Greek, 148 in number, are extant, called the "Epistles of Phalaris," but they have been proved beyond all doubt, by Bentley in his "Dissertation on the Epistles of Phalaris," to be a worthless fabrication of some rhetorician or sophist. [See BENTLEY.] The curious thing about these letters is that they show, as also do numerous other allusions of the later classics, especially two declamations of Lucian, that Phalaris was held to have been a cultivated patron of arts and literature, and a mild and beneficent ruler, driven unwillingly into occasional (and much over-exaggerated) severity by the necessities of policy alone.

PHALAROPE (*Phalaropus*) is a genus of wading birds belonging to the family *Scelopacidae*, or Snipes. The Phalaropes are distinguished by the structure of their feet, which have the toes bordered by membranous lobes and united by a web at the base. Three species are known, all inhabitants of northern climates, two occurring in Britain. The Gray Phalarope (*Phalaropus lobatus*) is not uncommon in Britain in the autumn on its passage to its winter quarters in the south. It is widely distributed in the northern parts of both hemispheres, breeding in the extreme north. Its entire length is about 8½ inches. In winter the plumage of the back is pale blue; the hind head and a line down the back of the neck grayish-black; the forehead, sides of the head, neck, and lower parts white. In summer the upper parts are dark brown, the feathers edged with yellowish-red, the lower parts light red. The phalarope is a good swimmer, and is often seen several miles out at sea. It feeds on crustaceans and molluscs. The Red-necked Phalarope (*Phalaropus hyperboreus*) breeds in the Orkney and Shetland Islands, and has a similar distribution to the former species. It is rather smaller than the gray phalarope. Its summer plumage is very beautiful, the upper parts being blackish-gray with the margins of the feathers reddish, the sides of the neck chestnut, and the under parts white. The nest is built in grass near the edges of lakes and contains four eggs. The third species is confined to North America.

PHALLOS, the Greek symbol for the generative principle in nature, and the centre of a widespread worship among Oriental nations. The Hindus have two emblems symbolizing the generative and productive powers (*Linga* and *Yoni*) still widely venerated. The ancient Assyrians, the Phœnicians, and through them the Jews worshipped the Phallos largely; the word translated by "grove" in the Authorized Version of our Bible (Heb. *Asherah*) really being this symbol hewn in wood and placed on the stone altar of Baal. The Jewish women wore hangings for the Asherim (2 Kings xxiii. 7); but the Jews were frequently sternly commanded to cut down and burn them. The Revised Version gives the Hebrew word

in most places, as Deut. xvi. 21, "Thou shalt not plant thee an *Asherah* of any kind of tree (Authorized Version, 'a grove of any trees') beside the altar of the Lord thy God," &c.; and again in Judges vi. 25, 26, when Gideon is commanded to "throw down the altar of Baal and cut down the *Asherah* (Authorized Version 'the grove') that is by it, and offer a burnt offering with the wood of the *Asherah* which thou shalt cut down," &c.

PHALSBURG, a town on the high road from Strassburg to Paris, in the former French department of Meurthe, but now included in the German province of Alsace, was founded in 1570 by the elector palatine, George John. It was ceded to France in 1661, and its fortress erected by Vauban in 1679. It checked the progress of the allies both in 1814 and 1815, and withstood a siege from the Germans from 16th August to 12th December, 1870, when it was forced by famine to capitulate. The fortifications have been razed.

PHANEROGAMIA is a botanical term for plants which have true flowers. It is used as opposed to **CRYPTOGAMIA**, which have no flowers. The phanerogams are divided into two great groups—**ANGIOSPERMS**, in which the ovules are enclosed in a seed vessel, and **GYMNOSPERMS**, in which the ovules are naked.

PHA'ON. See **SAPPHO**.

PHA'RAOH, the name given by the Hebrews to the kings of Egypt, and equivalent in meaning to the Roman "Cæsar." It was either derived from *Ra* or *Phra*, the sun, the chief title of all the ancient Egyptian kings; or in popular nomenclature, *Phouru*, the king. See **EGYPT**.

PHARISEES and **SAD'DUCEES** were two parties among the Jews in the time of Christ, who are often alluded to in the Gospels.

The prominence given to the law by its expounders in the schools and synagogues helped greatly to keep the Jewish people faithful to it. But some were more faithful to it than others, observed it more strictly, and embraced its leading principles with more ardour. They did not differ from other people in their belief—they held the same doctrines, they obeyed the same ordinances; but they cared much more for their religion, and the only way they had of showing this was by a more rigid fulfilment of the law.

The great struggle for freedom of religion in the middle of the second century B.C., led by the Maccabees, was largely maintained by these determined men, who readily sacrificed themselves and their families sooner than be false to their faith. The triumph of the Jews against their Syrian oppressors seemed for a time to secure an uninterrupted field for the principles represented by them. But after a time the effect began to wear off; earnestness declined, and many who had at first been zealous grew indifferent and neglectful. Greek influences gained in power, and dangerous tendencies to worldliness threatened the purity of religious observance. The people were often not in a condition to pay proper attention to the distinctions of clean and unclean. During the disturbances many legal duties had been neglected, even by priests and Levites, and the masses had certainly failed to comply with the full requirements of the law. This was especially the case in the matter of some of the proper religious taxes on the products of the land. Inquiry was made whether the tithes ordained in the law for the priests, the Levites, and the poor had been duly paid. This was not a mere financial arrangement for raising so much money. It was a religious duty; part of the tax was supposed to be paid to the real owner of the whole land, God: as such it was holy, and could not be lawfully enjoyed by a layman not belonging to the sacred caste. Any one who partook of food on which the proper tithe had not been paid was really guilty, therefore, of eating something which ought to have been given to God.

How was this difficulty to be avoided? Some did not mind, they were willing to run the risk. Others resolved that they would only buy food from dealers who could be trusted to have paid the proper tithe. This led to the formation of guilds or brotherhoods of persons who pledged themselves to the strict discharge of this particular religious duty. The members of these guilds bought and sold among themselves, and so kept aloof from the rest of their neighbours. They would not take a meal at anybody else's house, because they might unknowingly eat of some untithed food. Thus they came to be known as the people who had separated themselves from the community; and this grew into a name, they were called the *Perûshim* or Pharisees, i.e. the Separatists.

The strictness displayed in one direction naturally spread to others. The principle of separation became of great importance in the general question of the clean and unclean. First one was more precise than the rest of his comrades in the fraternity; then another followed him; by-and-by a third was discontented because these even were not precise enough, and so he aimed at a still greater austerity. Thus there grew up various grades among the fraternities, representing successive stages in the endeavour to carry out to the utmost the supposed requirements of the law. Entrance into the brotherhood was open to all; the candidate for admission declared himself ready to fulfil all religious demands, and took a vow before three members of the guild to keep the rules of the community faithfully. A period of probation preceded his reception into the several grades, lasting from thirty days to a year; and special instruction was imparted to him, in explanation of his new duties.

The fraternities of the Pharisees thus established attempted to give actual form in real life to the ideal demands of the teachers who spent all their energy on the study of the law and the determination of right conduct in all kinds of possible or impossible cases. But these brotherhoods, though they were formed out of the people, were not in opposition to the people. On the other hand, they were open to all; they claimed no privileges, they only imposed obligations; they took nothing from the people, they simply set before them a pattern of performance of duties which, in theory at least, every one recognized as binding on himself.

The impulse represented by the Pharisees could not always work unchecked, and the check came from a source from which we might not have expected it at first, viz.—the priestly families. The piety of the Pharisees was largely independent of the temple and its services. It did not in any way spring from the ritual; it dealt with a number of questions which had little or no concern with the public institutions and organization of religion. Hence it tended to throw the priesthood rather into the shade; at least it did not in any way promote their interests. Sometimes, indeed, some priest joined a fraternity of the Pharisees; but, in general, the leaders of the priesthood, who jealously maintained hereditary privileges which counted for little beside the personal ascendancy acquired by the extraordinarily devout, stood in distinct rivalry with them. These priestly families made up the party of the Sadducees. They were wealthy, and they had power in Jerusalem. That power they were not ashamed to maintain, sometimes by unworthy concessions to their foreign rulers. They stood for the temple, the priesthood, and official piety; while the Pharisees stood for the synagogue, the school, the teacher, and personal piety. Neither party could properly be called a sect; both had the same standards of faith, yet their religious ideas differed widely.

The unwillingness of the Sadducees to receive anything in addition to the actual words of Scripture determined their attitude to the belief in a future life, which was warmly embraced by the Pharisees. The doctrine did not really gain

a place among the ideas of the Jews until after the captivity, and was in part due, perhaps, to the influence of Persian beliefs. But it had now been established a long time in Jewish thought, and formed a regular part of the traditions of the teachers. Josephus says that on account of their doctrines the Pharisees had immense influence with the masses of the people, and whatsoever was done about divine worship, prayers, and sacrifices, was done according to their directions; inasmuch that the cities gave great attestations to them on account of their entire virtuous conduct, both in the actions of their lives and their discourses also. This statement of Josephus shows that the general teaching of the Pharisees was much more acceptable to the people than that of the Sadducees. And it was particularly so in connection with this doctrine of the life to come, and the associated belief in the kingdom of heaven, derived from the oracles of the prophets.

The Sadducees maintained that the fulfilment of the hopes uttered by the prophets was not really to be expected as a positive certainty. If men are free to choose, they argued, and can do one thing, or abstain from doing another thing, according as they like, how could any one foretell what was going to happen? Man had been made at the beginning by God, and then set to do as best he could. God had provided certain religious help in the law, let him obey this, and he would be happy and prosperous here, but let him not think there was anything more to come. No, said the Pharisees, God has not left man to himself; he is always working with man; he guides his actions to certain ends, and he will punish the wicked and recompense the righteous. The Sadducees, rich and comfortable in Jerusalem, on good terms with Herod or the Romans, did not care so much for the coming of that kingdom for which so many were longing and toiling and praying. They did not feel the bitterness of oppression; they were not anxious for a change which would make short work with their particular privileges; and they had not that passionate burning faith which could never be content while the people of God were mixed with idolaters and subject to heathen rule. So they did not share the great national aspirations; though Josephus significantly tells us that when they came into office "they had to conform to the notions of the Pharisees, because otherwise the multitude would not endure them."

Thus on the whole, the Pharisees, with all their extravagances, stood much nearer to the real life of the people. While the Sadducees remained at Jerusalem, the Pharisees were scattered throughout the country, mingling in popular movements, and knowing what was going on everywhere. They were not a very large body in number; Josephus only reckons them at about 6000 in the days of Herod. But with the rabbis they exercised the most powerful religious influence among the Jews. They led in the Sanhedrin, and their milder judicial practice helped to make them popular. "Judge not thy neighbour," said Hillel, "till thou art in his place." Of course there were among them men of various characters. The Sadducees accused them of doing their works of righteousness to secure the recompense hereafter, and professed great admiration of the maxim of Antigonus, "Be not like servants who serve their master for the sake of a reward."

Speaking broadly, the teachers and the Pharisees were the forward party in Jewish religion. They were the promoters of religious progress. Their ideal was that all the people should know and practise the law; and they endeavoured so to interpret it as to enable it to take up into itself new ideas, which the literal meaning did not always seem to justify. Their doctrine of a Mosaic tradition, independent of the Scripture, provided them with the means of accommodating fresh beliefs into their religious scheme without breaking continuity with the past. So in one sense they were the liberals of Judaism, and unquestionably prepared

the way for some of the teachings of Jesus. On the other hand, it was from them that he had to meet the most determined opposition; and it was by their help that he was brought to death. There is at least this to be said for them, and it is more than can be said for all persecutors—the fate which they inflicted on him they were ready to endure themselves. (Carpenter's "Life in Palestine when Jesus lived;" Kuenen's "Religion of Israel;" and Edersheim's "Messiah.")

PHARMACOPŒIA (Gr. *pharmakon*, a drug, and *poieo*, I make), the name given to a book containing directions for the preparation and compounding of drugs used as medicines. Such books are published in several of the European countries, under the authority of the Colleges of Physicians and Surgeons of those countries. The existing British Pharmacopœia is published under the authority of a "general council of medical education and registration of the United Kingdom," incorporated by Act of Parliament in 1864. Several editions of this work have been published. The art of preparing and compounding medicines is termed *Pharmacy* or *Pharmaceutical Chemistry*.

PHARMACY ACT. In order to diminish, as far as possible, the sad effects which had often resulted from medicines having been made up by ignorant and improperly qualified persons, the legislature passed the 31 & 32 Vict. c. 121, which came into operation on 1st January, 1869. The chief provisions of the Act are—that no person can now commence business as a chemist and druggist unless he has been duly examined as to his practical knowledge of drugs, medicines, and poisons. Those who were in the business before were exempted from examination, but all, whether under the old or new Act, now have to be registered, and to conform to such regulations as to the sale of poisons as may be made from time to time by the Pharmaceutical Society, with the consent of the Privy Council, under a penalty of £5. The Act does not extend to the business of any legally qualified apothecary, nor to members of the College of Veterinary Surgeons, nor to makers or dealers in patent medicines, nor to wholesale dealers supplying poisons in the ordinary course of wholesale dealing; neither does registry under the Act entitle any person so registered to practise medicine or surgery. No poisons must be sold either wholesale or retail unless labelled, and poisons must not be sold to any person unknown to the seller unless introduced by some person known to him, and before the delivery an entry is to be made in a book, and the signature of the purchaser attached, under a penalty not exceeding £5 for the first offence, and not exceeding £10 for subsequent offences. The Act applies to England and Scotland, but not to Ireland.

PHAROS, TOWER OF, a celebrated building, erected near Alexandria by order of Ptolemy Philadelphus, and reckoned as one of the seven wonders of the world. A strong light was always kept at the top of the tower to direct such vessels as sailed by night along those dangerous coasts.

PHARYNX is the cavity in which the food is received in its passage from the mouth to the œsophagus or gullet. It extends up behind the nose (the posterior nares) as well as behind the mouth. It is in fact a soft muscular, roughly triangular bag, closed at the top by the bony floor supporting the brain, open at bottom into the gullet, and on the front side into the mouth. It is constructed of a series of three layers of muscles with striated fibres, covered and lined by a strong fascia, and well supplied with mucous glands. In swallowing, the upper or nasal part of the pharynx is shut off by the rising of the soft palate, the food is then pushed into the pharynx by the tongue and squeezed down into the gullet by the powerful muscular constriction of the pharynx itself. The force of this is

somewhat astonishing, as may be proved by passing a small feather, &c., through the back of the mouth into the throat (pharynx), which grips it and pulls it with much power. The act of swallowing is quite automatic after once being started.

PHASEOLUS is a genus of plants belonging to the order LEGUMINOSÆ and tribe PAPILIONACEÆ. The species are mostly herbaceous perennials with a tuberous root-stock, the stem dying down every year. The flowers are arranged two or three together along axillary flower-stalks, and are distinguished from other papilionaceous flowers, such as those of the Pea (*Pisum*), by the keel or lower petal of the corolla terminating in a long spirally-twisted point. About fifty species are known, the majority of which inhabit tropical America, with a few species distributed in the warmer parts of the Old World.

Several species are cultivated for the sake of their pods and seeds, which are valued for human food. The kidney or French Bean (*Phaseolus vulgaris*), the haricot of the French, is of uncertain origin, but its home is probably Western Asia. Its cultivation, though comparatively recent, is now very general in Europe, the unripe pods being employed as a table vegetable and also for pickling, and the ripe seeds or haricots being used for soups, &c. Some varieties are runners, having twining stems, and others are dwarf. The Scarlet Runner (*Phaseolus multiflorus*), a native of Mexico, is distinguished by its numerous showy scarlet or white flowers and rough pods. For culinary purposes it is used in the same way as the French bean. The Sugar Bean (*Phaseolus lunatus*) is cultivated in the tropics of both hemispheres. It is probably a native of Brazil, introduced into Africa through the slave trade, whence it spread into India. See BEAN.

In India several species are extensively cultivated. *Phaseolus acutifolius* is an annual, cultivated chiefly as a fodder; the seeds though eaten are not much valued. *Phaseolus trilobus*, like the last species, is wild throughout India, and is greatly cultivated. *Phaseolus Mar* and *Phaseolus Mango* (the black and green gram) are greatly cultivated in India and the Nile valley, and prove of great value as food when the rice crop fails. A few South American species are cultivated for the beauty of their flowers.

PHASMIDÆ is a family of insects belonging to the order ORTHOPTERA and nearly allied to the Mantidæ. The Phasmidæ are among the most extraordinary of insects. Most of them resemble very closely portions of the trees on which they live, either green twigs or dry withered branches or leaves; hence the names "Walking Sticks" and "Leaf-insects" given to these insects. They are distinguished from the Mantidæ by the shortness of the prothorax, and by the simple character of the first pair of legs. The body and legs are generally long, the wings frequently absent, and portions of the legs dilated into leaf-like lobes. The majority of the species are tropical, and here attain a large size, some being 9 and 10 inches long. Two species occur in the south of Europe, one, Rossi's Stick-insect (*Bacillus Rossi*), being found in Italy and the south of France. This species is a little over 2 inches in length, and presents a close resemblance to a withered twig, having a slender brown body, very long legs, and no wings. The winged species belonging to the genus *Phyllium* [see LEAF-INSECT], found in the tropical parts of the Old World, simulate leaves. The Phasmidæ are nocturnal in their habits, and feed upon leaves.

PHEASANT is the name given to several game birds of the family Phasianidæ.

The Common Pheasant (*Phasianus colchicus*) is said to have been brought from the banks of the Phasis in Colchis into Greece by the Argonauts, and it is still abundant in South-west Asia. It was certainly well known to the ancient Greeks, for Aristophanes alludes to it several times,

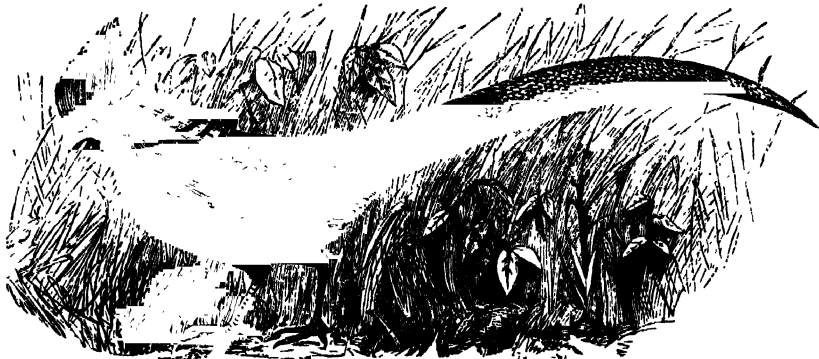
and both Greeks and Romans esteemed it for the table. Its introduction into Britain was probably due to the Romans, and it has now become naturalized both in this country and in the south of Europe generally. It is carefully preserved in England for sporting purposes. Pheasants have been introduced into New Zealand with great success.

The general appearance of the pheasant is too well known to need any description. The plumage of the male, especially at the breeding season, is very brilliant, while the female is protected by her dull brown colour, so that she easily escapes detection on the ground. The male is about 3 feet in length, of which the tail takes about 2 feet; the female is about a foot smaller. The haunts of the pheasants are woods and thickets, but they never thrive except in the vicinity of water, and are even fond of taking up their abode among the rushes and osiers of marshy places. They are terrestrial in their habits, walking and running along the ground in the same way as the common fowl, although with more grace and swiftness. Their flight is heavy and whirring, and they rarely take wing unless menaced with immediate danger. Though they seldom voluntarily take to the water, they possess considerable powers of swimming. During the summer they even roost on the ground, but

pass the long nights of autumn and winter upon the branches of trees. The cry of the cock pheasant is a peculiar short crow.

The food of these birds consists of various kinds of seeds, varied with wild fruits, green herbage, and insects. Ants and their larvæ and pupæ are favourite articles of diet with them. They may be seen eating blackberries, sloes, and haws, and their crops are sometimes found to be filled with acorns. In a few recorded instances such animals as blindworms and field-mice have been found in their crops. In preserves it is found necessary to provide them with artificial food to keep them from wandering away. For this purpose beans, peas, and buckwheat are sometimes sown together, the whole crop affording both food and cover. Potatoes, maize, and barley are also supplied.

Like domestic fowls, the pheasant is polygamous, and the males and females only associate in the breeding season. The eggs are from ten to fourteen in number, and of an olive-brown colour; they are deposited in a small hollow lined with dead leaves, and scratched in the ground among long grass, or in the midst of bushes. The female not unfrequently shares her nest with another of her own species, or even with a partridge. The young are hatched by the end of May or the beginning of June. In preserves



The Gold Pheasant (*Phasianus pictus*).

the eggs are generally placed under domestic hens, and the young brought up by hand, great care being necessary in rearing them. Even when thus artificially reared the pheasant is very timid and half-wild.

Pheasant shooting begins in England and Scotland on the 1st of October. Pheasants were formerly taken in England in snares and nets, or brought down by the cross-bow or by falcons.

The female pheasants, like the domestic hens and peafowls, sometime assume the plumage of the cock, when from old age or from disease of the ovaries they are no longer capable of reproduction. The pheasant breeds freely with other game birds, hybrids between it and the domestic fowl and the black grouse, as well as with other species of pheasants, having been recorded. White and pied varieties are not uncommon; a rarer variety is the Bohemian pheasant, which is of a pale buff colour.

The Ring-necked Pheasant (*Phasianus torquatus*) breeds freely with the common pheasants, and the hybrids are fertile. It is a native of China, and is almost as abundant in England as the common pheasant. It is distinguished by its smaller size, broad white collar, silvery-gray wing-coverts and rich buff flanks. The Green Pheasant (*Phasianus versicolor*), a native of Japan, also breeds freely with the common species. Other species that have been introduced into England are Reeves' Pheasant

(*Phasianus reevesii*), a native of Northern China, which has a very long tail, 5 or 6 feet in length, white marked with black bars, and the Copper Pheasant (*Phasianus amherstii*), from Japan. Lady Amherst's Pheasant (*Phasianus* or *Thaumalea amherstii*, Plate, fig. 1) is a beautiful Indian species. The top of the head is of a dark blue colour, but is adorned with a crest of slender crimson feathers; and from the sides and back of the head descends a beautiful white ruff, each feather of which is terminated by a green band; the tail measures upwards of 3 feet in length, and is of a grayish-white colour, with numerous broad green bars on each feather.

The Gold Pheasant (*Phasianus pictus* or *Thaumalea picta*) is the most brilliant of all pheasants. The crest is yellow, and the feathers of the ruff golden yellow, barred with black at the tips. The back is metallic green, the rump and tail-coverts yellow, the wings blackish, with the secondaries deep brown and the tertiaries blue, and the whole lower surface is bright red; a portion of the tail-coverts project in long hackle-like plumes of a red colour, and the elongated tail-feathers are mottled with brown and black. It is domesticated in its native country, China, and is found in aviaries in England. The Silver Pheasant (*Phasianus* or *Euplocamus nycthemerus*, Plate, fig. 2), also a native of China, has been introduced into England, and is not uncommon in aviaries. It is a large and

powerful bird, justly celebrated for its beauty. The back and tail are white, with each feather delicately pencilled with black lines; the under surface is bluish-black, and the head is adorned with a crest of elongated purplish-black feathers. The Fire-backed Pheasant (*Euplocamus ignitus*) is a large handsome species, native of Sumatra. The general colour of the plumage is a deep steel-blue, but the feathers of the lower part of the back are of a most brilliant fiery orange colour, whence the name.

The IMPEYAN PHEASANT or Monaul (Lophophorus), and the ARGUS PHEASANT are noticed elsewhere. Other species are the Eared Pheasants (*Crossoptilon*) and the Pucras Pheasants (Pucrasia).

("Pheasants: their Natural History and Practical Management," by W. B. Tegetmeyer, London, 1881.)

PHEIDIAS, the most celebrated sculptor of antiquity, was a native of Athens. He seems to have been born between 490 and 480 B.C. His father's name was Charmidēs. According to ancient writers he had two masters, Hippias and Ageladas. He was extensively employed upon great public works during the administration of Kimon. Afterwards, when Periklēs attained the supreme power, Pheidias seems to have been consulted on all occasions in which the embellishment of the city was contemplated. Among the more remarkable objects upon which his talents were at this time exercised, the temple of Athēna, called the Parthenon, justly claims pre-eminence. [See PARTHENON.] The architects employed upon it worked under the direction and superintendence of Pheidias, and the whole construction lasted from B.C. 447 to 433. The statue of the goddess within the temple was the work of Pheidias himself alone, and, with the exception of the statue of the Olympian Zeus, which he made at Elis, was the most celebrated of his performances. The flesh parts of the figure of Athēna were made of ivory. The eyes were of precious stones. The drapery throughout was of gold—of which metal, it is said, no less than forty talents' weight were used. The people, desiring to have all the glory of this work, had a decree passed prohibiting Pheidias from inscribing his name on the statue; but he contrived to introduce his own portrait (as an old bald-headed man hurling a stone) in the representation of the combat of the Athenians and Amazons which decorated the shield. The statue stood 40 feet high, was dedicated B.C. 438, and the sculptor soon after went to Elis. The animosity against Periklēs reached its height, and since Periklēs himself was too strong to attack, his friend Pheidias was accused of having misapplied part of the gold intrusted to him for the statue, but the charge fell to the ground. It was then declared that the sculptor was guilty of sacrilege in having placed his own portrait on the shield of Athēna, B.C. 432. Some accounts say he was thrown into prison, and there died by poison; others, that he was banished. From B.C. 437 to 433 Pheidias was employed in Elis to execute a costly statue of the Olympian Zeus. This statue was the most renowned of his works. Of colossal dimensions, it was, like the Athēna, *chryselephantine*, that is, inlaid with gold and ivory. The statue was held in the utmost sanctity, extraordinary precautions being taken to preserve it unharmed. Its care was intrusted to the family of Pheidias, and Pansamas found his descendants still in charge five centuries later. It was always veiled except on occasions of solemnity, when divine honours were paid to it. The god was represented seated on a splendid throne of cedar wood, enriched with gold and carved woods and precious stones, holding in one hand a magnificent sceptre, and in the other a statue of victory, and bearing on his brow a crown of olive. The figure, seated as it was, reached nearly 60 feet in height. The attitude was expressive of calm sublimity, befitting the sovereign ruler of the world. This wonderful work perished by fire at Constantinople, whither

the Emperor Theodosios had removed it (A.D. 475). Another very famous statue of Pheidias was a colossal bronze of Athena Promachos, 50 feet high exclusive of its lofty pedestal, which stood out in the open on the Akropolis, with raised spear and shield. Its great height made it seem to tower over and protect the city. It even served as a guide to those at sea, being distinguishable as far off as Sardinia Cape.

Pheidias has been called the "sculptor of the gods." He brought to perfection the grand or sublime style of sculpture. The artists before him had a hard, stiff, dry manner; and those after him proved unable to maintain his lofty principles. The endeavour after sublimity was soon abandoned for the search after beauty. The latest work of importance on the subject is the "Art of Pheidias," by Dr. Waldstein, the reader in classical archaeology to the University of Cambridge, published at the University Press in 1886—an exhaustive and remarkably clever work.

PHENICIN, a brown colourless matter obtained from phenol by the action of nitro-sulphuric acid. It is a brown powder soluble in alcohol, ether, and acetic acid, but insoluble in water. It is soluble in alkalis; the solution has a violet blue colour. It dyes silk and wool brown without a mordant; the colour becomes dark red on immersion in solution of potassium chromate, and deep purple if previously mordanted with stannate of soda.

PHENOL, Phenylie Alcohol, or Carbolic Acid. This well-known substance is obtained in large quantity from coal-tar, to which it imparts its antiseptic properties; commercial creosote often consists entirely of it. The oil obtained from the tar by distillation is redistilled, and the part boiling between 150° and 200°C. (302 to 392° Fahr.) is saturated with caustic potash, forming a crystalline mass, from which the phenol is separated by hydrochloric acid. It can also be obtained from salicylic acid.

Phenol crystallizes in long colourless needles, melting at 35° C. (95° Fahr.), and boiling at 187° C. (368° Fahr.); the formula is C_6H_5O . It is slightly soluble in water, to which it communicates the peculiar odour of creosote. It is very soluble in alcohol, ether, and acetic acid. It forms a hydrate with water, crystallizing in six-sided prisms, and having the formula, $2C_6H_5O.H_2O$. The aqueous solution coagulates albumen. It is a strong antiseptic, removing the odour from tainted meat, and preventing decomposition. It is largely employed in surgery, in antiseptic dressings; its introduction by Sir Joseph Lister for this purpose having revolutionized surgery and rendered many operations successful, which before its use were dangerous or impossible. As a general disinfectant it is also very largely used. It is soluble in glycerine, in oils and fats, and in vaseline, and in combination with these is much employed in medicine and surgery, and in soap and solution for household purposes. Mixed with smelling salts it is found an excellent remedy for cold, influenza, and hay fever.

The metallic phenates are unstable compounds. Ethylie phenate or phenetol ($C_8H_{10}O$) is a light colourless liquid of agreeable odour, insoluble in water, and boiling at 172° C. (342° Fahr.). There are a number of phenol derivatives produced by the action of chlorine, bromine, and iodine, and several nitro-derivatives. These are all acids—as, Dichlorophenic acid ($C_6H_4Cl_2O$), trichlorophenic acid ($C_6H_3Cl_3O$), pentachlorophenic acid (C_6HCl_5O)—depending on the replacement of hydrogen by chlorine or the other haloids; and as the hydrogen may be replaced by two or more, such as dinitro-bromophenic acid ($C_6H_2Br(NO_2)_2O$), there is a very large range of these compounds.

The best known and most important is *trinitrophenic* or *picric acid*, known also as *carbazonic acid*. This important dyeing material is obtained by the action of nitric acid on phenol, but it is also the ultimate product of the

action of nitric acid on many other substances, such as indigo, salicin, aloes, benzoïn, silk, &c. Picric acid crystallizes in yellow octahedrons; it is very bitter, and is soluble in water, the solution imparting a strong yellow stain to the skin; a solution containing $\frac{1}{10}$ part is distinctly yellow. When heated it decomposes with explosive force; the formula is, $C_6H_3N_3O_7 = C_6H_3(NO_2)_3O_4$. It forms a number of salts known as picrates, mostly crystallizable, yellow, and bitter, and having the general formula, $C_6H_2MN_3O_7$. The picrate of potassium is only slightly soluble in water. Picric acid is largely used in dyeing yellow, especially silk and wool, which it dyes without a mordant; it has no affinity for cotton and flax, and can be used for distinguishing the threads of these materials from those of silk and wool. It is also employed in the laboratory as a test for albumen and for glucose.

PHENYL. This body is the radical of phenol; the formula is, C_6H_5 . It crystallizes in iridescent scales, melting at 69° C. (156° Fahr.), and sublimes at a higher temperature unchanged. With chlorine and bromine it forms chlorophenyl ($C_6H_4Cl_2$), and bromophenyl ($C_6H_4Br_2$), both crystalline bodies, insoluble in water, soluble in ether.

Nitro-phenyl, $C_6H_4(NO_2)_2$, crystallizes in colourless needles, insoluble in water, and only slightly soluble in alcohol.

Phenyl hydride or *benzene* (C_6H_6) has been already described. See **BENZENE**.

PHENYL ETHER ($C_6H_5O.C_2H_5$) is a colourless liquid, boiling at 133° C. (271° Fahr.), which, by oxidation, is converted into benzoic acid.

PHENYLAMINES. These are organic bases derived from ammonia (NH_3) by the substitution of one or more atoms of phenyl for hydrogen. The most important of these is monophenylamine or aniline, $C_6H_5N = C_6H_4N$. This important body has been already described. See **ANILINE**.

PHENYL-AMMONIUMS are compounds derived from ammonium (NH_4) by the substitution of phenyl for hydrogen. There are a great number of these substitution products forming crystalline salts with acids, as the chloride of phenyl ammonium ($C_6H_5NH_4Cl$).

PHENYLENE DIAMINE ($C_6H_4N_2$) is a base obtained from nitraniline by the action of reducing agents. It is a heavy oil, resembling aniline, becoming crystalline below 63° C. (145° Fahr.), and boiling at 287° C. (548° Fahr.) It is very soluble in water and alcohol; it combines with acids, forming a number of soluble crystalline salts. There are also a great many derivatives from this base.

PHIDIAS. See **PHIDIAS**.

PHILADELPHIA, a city of Pennsylvania, in the United States of North America, 80 miles south-west from New York, is situated between the rivers Delaware and Schuylkill, 5 miles above their junction, and 120 miles from the sea by the course of the Delaware. The city extends 6 miles in length along the banks of the Delaware, and more than 3 in width between the rivers. It is regularly laid out, the streets crossing each other at right angles. They are traversed by railways, having 600 cars and over 3000 horses. Philadelphia was formerly the capital, and is still the second city of the United States. The population in 1790 was 42,500; in 1850, 408,762; in 1870, 674,022; and in 1880 it was 847,170, so that it is the second city in the United States as regards population.

The houses, formerly built with great uniformity and neatness, mostly of brick, are now erected in every variety of style; and the city, from presenting an appearance verging on the monotonous in architecture, now runs the risk of being spoiled by excess of irregularity. The streets are kept very clean, the common sewers emptying into the

Delaware. Several of the principal thoroughfares have rows of trees on each side. There are many public squares, none of which are large, but some are finely laid out, and ornamented with trees and walks. Fairmount Park, however, of nearly 3000 acres, is one of the largest parks in the world. It contains a garden of the Zoological Society, the first in the States. The area of the city is about 12 square miles. It has 1000 miles of streets and roads, nearly 600 miles of which are paved. The beautiful cemetery of Laurel Hill is $\frac{3}{4}$ miles north of the city, on the east bank of the Schuylkill.

The public buildings are numerous; the majority are built of white marble, and some are very handsome. The Girard (formerly the United States) Bank, is built after the model of the Parthenon at Athens. The Bank of Pennsylvania and the United States Mint have Ionic porticoes. The Merchants' Exchange has a Corinthian portico; it is considered one of the most beautiful structures in the United States. The United States Naval Asylum has an Ionic portico, and is surrounded by ornamental grounds. Girard College, about a mile from the city, solely for the education of orphan children, has a Corinthian portico, and is entirely surrounded by Corinthian columns, 6 feet in diameter and 55 feet in height. There are also a custom-house, United States navy-yard and arsenal, an elegant post-office, and a very fine range of public buildings, erected in 1874-76. The old State-house, erected in 1735, where the Congress was held in 1774 which formed the constitution of the United States and declared the independence of the Union in 1776, still exists, and the room in which the members sat is carefully preserved without alteration. There are over 400 places of public worship, among which are Presbyterian, Methodist, Baptist, and Roman Catholic churches, and two Jews' synagogues. Among the places of amusement are an opera-house, several theatres, and some public gardens. There are a penitentiary and several houses of correction and refuge, besides a county prison. Of the numerous charitable institutions one of the most ancient is the Pennsylvania Hospital, founded in 1750, which has an anatomical museum, a library of 8000 volumes, and is one of the best institutions of the kind in the Union; there are also a county almshouse, containing nearly 4000 rooms; United States naval hospital, and deaf-mute, blind, and Magdalen asylums. Of the literary institutions the most important are—the University of Pennsylvania, founded in 1791; the Jefferson, Pennsylvania, and Medical colleges; the American Philosophical Society, founded in 1740; the Academy of Natural History, with a library of 14,000 volumes, and an extensive collection; the Philadelphia Library, containing nearly 70,000 volumes, founded by Benjamin Franklin; the Franklin Institute; the Athenæum, and the Historical Society. The academies and public schools are very numerous, and the cost of each pupil is, upon a fair average, considerably less than in any other city in the United States. In the Girard College, previously mentioned, orphans are admitted between the ages of six and ten, and remain (according to merit) until between fourteen and eighteen, when they are apprenticed. The university has over 1000 students. The Fairmount Water-works are on the east bank of the Schuylkill, 2 miles north-west from the city. The city is governed by a select council consisting of one member for each of the thirty-one wards, and a common council composed of one member elected for every 2000 citizens, presided over by a mayor.

Philadelphia communicates by railway with New York, Trenton, Columbia (on the Susquehanna), Baltimore, Reading, and Norristown, and by branches with all the great lines in this part of the Union. The largest ships come up the Delaware to the town, the river at this point being nearly a mile wide. The Schuylkill is also navigable for

smaller vessels to the first bridge. Steam vessels communicate regularly with New York, Baltimore, Liverpool, &c. Railways in various directions make Philadelphia a great thoroughfare, and by a canal it communicates with Pittsburgh and the great valley of the Mississippi. The two rivers are frozen over for some time in the winter, when the average temperature of the city is about 30°. In summer it is 71·4°—mean for the year, 51°.

Philadelphia has excellent and extensive markets, and large quantities of provisions and live stock are brought hither from the interior. It is also the great dépôt in the Union for coal and petroleum. The other exports are iron, wheat, and wheat flour, Indian corn, and agricultural products generally. The chief imports are cotton, woollen, and silk goods; sugar, coffee, and tea; wines, brandies, spices, and dye-stuffs. Opium is taking a growing position among the imports. In point of shipping Philadelphia is the fifth port in the Union, being in this respect inferior only to New York, Boston, San Francisco, and New Orleans. A large proportion of the goods destined for Philadelphia, however, are landed at New York, and forwarded by railway, and therefore the shipping returns do not fully represent the actual state of its commerce. The number of foreign, home, and coasting vessels entering the port is very large.

Philadelphia is the first manufacturing city in the United States, and its importance in this respect is gradually increasing. Iron and woollen fabrics are the most extensive manufactures, comprising nearly one-third of the whole; other articles are carpets, hosiery, sugar, clothing, silk fringes, cotton fabrics, chemicals, medicines, dental and surgical instruments, carriages, &c.

Philadelphia was founded in 1682 by William Penn, whose residence, Pennsbury Manor, was near the city. On 5th September, 1774, the members of the first Congress assembled here, and adopted the "Declaration of Rights," the preface to the "Declaration of Independence," which was proclaimed at Philadelphia in April, 1776. The town was held by British troops from September, 1777, to June, 1778; it was the capital of Pennsylvania till 1799, and the seat of the federal government till the year 1800.

PHILADELPHUS is a genus of plants belonging to the order SAXIFRAGACEÆ. The greatest number of species are indigenous in North America; whence they have been introduced into the shrubberies of this country, to which they form a highly ornamental addition. The best known species, *Philadelphus coronarius*, is the Syringa or Mock Orange of our gardens. The peculiar sweetish odour of the large white flowers is due to the presence of an essential oil, which was formerly considered to have tonic properties. The leaves taste like cucumbers. The Syringas are shrubs with deciduous opposite exstipulate leaves, and the flowers arranged in cymes; the terminal flower in each cyme has five petals, while the other flowers have only four. The calyx is valvate, with a persistent limb; the petals alternate with the segments of the calyx; the stamens are indefinite; the ovary is half inferior, of four to ten cells, with numerous ovules; the fruit is a four to ten-celled capsule, with albuminous pendulous seeds.

PHILÆ, an island of Upper Egypt, in the Nile, 5 miles above the First Cataract and 6 miles S.S.W. of Assouan. Its length is only 400 yards, but it is full of fine Egyptian remains. The oldest monument on the "Sacred Island" is not much anterior to the time of Alexander; so that Philæ presents not nearly so inviting a field to the mere archaeologist as some other sites in Egypt; but the beauty of its position and of the general grouping of the buildings place it far above anything to be found elsewhere in Egypt for picturesque loveliness. The approach by water is most charming. The island as seen from the level of the boat rises straight out of the heart of the river, an enchanting

vision of pylons and colonnades, set in waving palms and framed by piles of rugged rocks near by, and by purple mountains in the distance. The beautiful workmanship of the temples seems even at a very little distance, when thus approached, to show no sign of age; it seems a heresy to call them "ruins." The principal building is the well-known Temple of Isis with its fine double pylon, well shown in the Plate illustrating this article. This temple is due in greater part to Ptolemy Philadelphos, but was worked at by many succeeding Ptolemies, and bears also subsequent sculptures of the date of the Roman occupation. The best known temple is that seen to the right and the back of the Plate, familiarly called "Pharaoh's Bed."

Philæ was called "the Sacred Island" because it was believed to be one of the many burial-places of Osiris. No one might land upon its shores nor approach them without permission. The fish and the birds were said to respect it. To visit Philæ was to the ancient Egyptian what a pilgrimage to Mecca is to the Mohammedan of to-day. When therefore the edict of the Emperor Theodosius in 379 A.D. Christianized the world, the decree stopped at the cataract. Beyond Assouan in the sanctuaries of Philæ the worship of Isis long went on. How long we know not, but inscriptions as late as 453 A.D. show that the mysteries of Osiris and his partner Isis were still being celebrated at that time. Eventually, however, in Justinian's time we find the Copts conquerors of the island for their faith. The conquest by the Turks quite put an end to the Christianity of Upper Egypt, and thereafter Philæ, up to the tenth century, figured as the furthest fortified outpost of the Moslem invaders. It was still inhabited when the French army led to Egypt by Bonaparte took it in 1799, under General Belliard, and recorded the fact with French national vanity, by a boasting inscription carved in the doorway of the great pylon of the Temple of Isis. The natives fled or were murdered, and the place was so full of evil memories that it was left deserted. It remains to this day absolutely solitary.

PHILEMON, a writer of the New Comedy, was born at Soli in Cilicia, and began to exhibit comedies a little earlier than Menander, and before 328 B.C., in the reign of Alexander the Great. He is said to have written ninety-seven comedies, of which only fragments exist, which are generally published with those of Menander. The best edition is by Meineke, Berlin, 1841.

PHILEMON and BAUKIS, the types of conjugal love in old age, and of humble hospitality in classical literature, were fabled to be a kindly hearted, attached, old couple of Phrygian peasants who lived a blameless life. Zeus and Hermès visiting Phrygia were caught in a fearful storm, and no one would shelter them in that inhospitable region save Philemon and Baukis. To reward them Zeus preserved them from the inundation which continued to devour the surrounding country, by carrying them to a hill, where they built a temple to him. Of this temple they remained the guardians till their death, and at their prayer they were both permitted to die at the same instant. Each desired not to outlive the other. They were transformed at death into two trees, the boughs of which lovingly interlocked.

PHILEMON, EPISTLE TO. Philemon was a man of distinction, if not a presbyter, of the church at Colossæ, and was probably converted from heathenism by St. Paul. He had a slave named Onesimus, who robbed his master and fled to Rome, where he met with St. Paul, a prisoner there, about 62 A.D., and through him he became reformed. St. Paul then wrote the Epistle to Philemon, and sent it to Colossæ by Onesimus.

PHILHARMONIC SOCIETY, a celebrated musical society for the performance of orchestral, instrumental, and vocal music, but more especially the former, founded in 1813, and honourably distinguished to the present day by the high standard of its programmes and the excellence and

finish of its performances. Many of the most distinguished composers have written some of their best works specially for it, as Haydn, Beethoven (Choral Symphony), Cherubini, Spohr, Mendelssohn (Italian Symphony, Trumpet overture, the *Infelice scena*), Bishop, Henry, Bennett, and Macfarren; and among the conductors were Cherubini, Spohr, Weber, Mendelssohn, Costa, Wagner, Sterndale Bennett, Gounod, &c. The honourable relations entertained with Beethoven, so that when the composer (erroneously) thought himself in want he distinguished the society by applying to it, are well known. The society instantly forwarded him 100 guineas.

PHILIP (Gr. *Philippos*, that is "lover of horses"), the name of several kings of Macedonia, of whom two deserve particular notice:—

PHILIP II. OF MACEDON was a younger son of Amintas II., and succeeded (B.C. 359) at the age of twenty-three years to a throne which, after the death of his father, and during the reigns of his two elder brothers, Alexandros and Perdikkas, had been shaken by foreign invasion and civil war. But the young king was endowed with talent and energy; and a residence during his boyhood at Thebes, whither he had been sent as a hostage while Pelopidas and Epameinondas were in power, had given him great advantages. On his accession to the throne his kingdom was overrun by the Illyrians, who had defeated and slain his brother Perdikkas; his own title was disputed by two pretenders. But he soon induced the adherents of his rivals to abandon their cause; and he not only repelled the Illyrians and Paionians, but invaded their territories. He further strengthened himself by a marriage with Olympias, daughter of the King of Epeiros, who became the mother of Alexander the Great.

From the period of the full establishment of his authority, Philip seems to have commenced the design, which he steadily pursued and accomplished, of destroying the power and influence of the Athenian people on the northern shores of the Ægean Sea. After the general peace which followed the battle of Mantinea (B.C. 362), Athens became the most prominent state in Greece, and many of the islands of the Ægean were again in the relation of subject allies to her. But the oppression of Athens again broke the bond of union, and produced (B.C. 358) the Confederate or Social War. Philip took advantage of this opportunity to gain possession of Amphipolis, Potidaia, and other towns on the north coast of the Ægean. He also got possession of the gold mines at Pangaios in Thrace, near which he built or enlarged a city called, after his name, Philippoi (Lat. *Philippi*). These mines were very productive. They furnished the gold with which the Macedonian king coined his "Philips," and supplied him with the arms which he well knew how to use. A fine didrachma of Philip's is shown in Plate I., COINS. The siege of Methone, the key of the border-land between Macedonia and Thessaly, though it cost Philip the sight of an eye, was in his mind well worth that price, since its fall lay open the way to Greece (B.C. 352). The first occasion for interfering in the domestic politics of the Greeks was afforded to Philip by the Phokian or Sacred War, which commenced before the close of the contest between Athens and her allies. Availing themselves of their influence in the Amphiktonic Council, the Thebans had accused the Phokians of having cultivated lands which had been devoted to the Delphic god. The Phokians were found guilty by the Amphiktonic Council, and condemned to pay a fine so enormous, that for its liquidation their whole country was declared forfeit to the god. The Phokians, supported by Athens and Sparta, commenced a sanguinary war against the Thebans and their allies, who applied to Philip for aid; and the Macedonian king having passed the defiles of Thermopylai (Lat. *Thermopylae*) soon brought the war to an end. The Phokians were now compelled to surrender unconditionally; their towns were

destroyed, and the inhabitants disarmed and heavily fined and their privileges at Delphi and votes in the Amphiktonic Council were transferred to Philip. Thus ended (B.C. 346) the Sacred War.

Philip had already turned his arms against the cities of the Propontis and the Thracian Chersonesos; and Demosthenes now urged the Athenians to send an armament, which, under the command of Phokion, compelled him to raise the siege of Byzantium (B.C. 339). But the triumph of the great orator and the disappointment of the ambitious prince were alike momentary; and the event soon proved how unequal was the conflict between the desultory impulse which could be given to a feeble and divided democracy, and the concentrated power of a monarch of high talent and immense resources. In the very next year after his repulse before Byzantium, Philip found a pretext for appearing again in arms in Greece itself. He was appointed general in a new sacred war against the people of Amphissa; and after reducing that city, he seized Elateia, the key of Boiotia, at the head of 32,000 veteran troops. The Athenians were filled with dismay; but the eloquence and activity of Demosthenes animated them to extraordinary exertions, and induced the Thebans, Corinthians, and others to join with Athens in the cause of independence. The numerical superiority of the confederates, however, though they fought with great bravery, could not prevail against generalship and discipline; and in the fatal battle of Chaironeia (B.C. 338) they were totally defeated.

Philip treated the party that had been hostile to him at Thebes with great severity; and he imposed a Macedonian garrison upon the subjugated city. To the Athenians, on the contrary, he behaved with the greatest clemency, and he granted them peace upon very easy terms. He wanted their aid in the accomplishment of the dream of his life, that the Greeks should undertake a war against the Persian Empire, and that he should be appointed commander-in-chief, with power to apportion the contingent of each Grecian state. He was not destined, however, to lead the West in its first great invasion of the East. While celebrating the nuptials of his daughter Kleopatra, he was stabbed by a young Macedonian of his own body-guard, Pausanias, whose motive for the deed, as he was himself put to death on the spot, could not be ascertained, but has been with some probability ascribed to motives of personal revenge.

Thus fell Philip (B.C. 336), at the age of forty seven years, and in the full vigour of life and intellect, at the moment when he seemed to be entering on a career of glory. He was endowed with great political sagacity, and was a wise and popular administrator in his own kingdom. Philip had a large number of wives and concubines; and it was a marriage of his with a certain Kleopatra, daughter of one of his generals, which drove into open enmity his wife Olympias and her equally high-spirited son Alexandros (Alexander the Great): it was always held likely by the ancients that these two connived at Philip's murder.

PHILIP V. OF MACEDON, the only other of the Macedonian kings of that name whose life and reign merit some attention, ascended the throne (B.C. 220) at an early age, on the death of his uncle Antigonos Doson. He became the head of the Achaian Confederation. His successful generalship soon disposed the Ætolians to peace, which Philip granted in order to have time to turn his attention to Italy, where the Romans were engaged in their contest with Hannibal. After the battle of Cannæ (B.C. 216) he formed an alliance with Hannibal, but he gave him no effectual assistance. When the Romans began to secure a predominance over the Carthaginians, they determined to punish Philip, and at last they declared war against him. He was defeated, B.C. 197, at Kunoskephaloi (Cynoscephalæ) in Thessaly, by the Roman consul T. Quintus Flaminius, and he obtained peace on tolerable terms. He died in 179,

and was succeeded by his son Persens, last king of Macedon, who lost his crown in his contest with the Romans.

PHILIP (*Philippe*) was the name borne by six of the kings of France.

PHILIP I. OF FRANCE (1060–1108) was the son of Henry I., whom he succeeded as a lad eight years old, in the midst of a disastrous war with William the Bastard, duke of Normandy. During the boyhood of Philip, Duke William conquered England and became its king; and his manhood saw the First Crusade (1096) and the establishment of the kingdom of Jerusalem (1099). So great a part did the French play in this that then and ever since the Oriental name for Christian strangers from the West is Franks (*Feringhi*). But these stirring events passed by the king without his taking much personal part in them. His chief aim was to hold his own against Duke William, and for twelve years continued hostilities went on. At last a taunt of Philip's caused William's death. The Conqueror had grown stout, and it seemed witty to his opponent to ask "When he thought to lie-in?" William was furious at the insult, and assembling his utmost power he determined to crush France altogether, sending as his reply that he "would offer 10,000 lances instead of tapeis for his safe delivery." He ravaged the French borders with fire and sword. His horse stumbled on some hot ashes as he pressed forward the siege of Mantes; he was thrown violently on the pommel of the saddle and died soon after (1087). Philip breathed more freely; and in the ensuing English troubles he supported Robert against William Rufus.

Philip had been badly defeated at Montecassel by Count Robert of Frisiau, in an expedition against him in 1071, but with the curious result that he had married Robert's daughter Bertha, in 1072. By 1090 he had tired of Bertha, and moreover cast longing eyes on Bertrada, the lovely wife of Fulk IV., count of Anjou (Fulk Rechin), ancestor of our Henry II. and the Angevin or Plantagenet kings. Philip therefore locked up Bertha in prison and abducted Bertrada, with whom he went through the form of marriage. The injured husband exclaimed loudly, and the Pope threatened. Bertha died in 1094, and the king's marriage was recognized at the royal council at Rheims, 16th September. But this the Pope (Urban II.) at the Council of Clermont (1095), assembled to announce the First Crusade, sternly refused to sanction. Philip submitted, sent Bertrada back to her husband, put off all insignia of royalty, crowned his son Louis (in 1098), and thenceforth reigned only in name. He stole Bertrada again in 1100. Promptly followed the papal excommunication, and eventually the wretched king once more parted with the queen who had cost him so dear, and was once again absolved (1104). A horrible fate of hell, however, now seized upon him; he voluntarily renounced his privilege of burial in the royal vaults at St. Denis, as being too great a sinner, and hastened to enrol himself among the Benedictine monks, and so in 1108 he died at Melun clad in the monastic gown.

PHILIP II. OF FRANCE, usually called **PHILIP AUGUSTUS**, is a familiar figure to Englishmen as the treacherous ally and fellow-crusader of our knightly Richard Cœur de Lion. He was the son of Louis VII., was born in 1165, and reigned from 1179 to 1226. The great work of his life was the consolidation of France. When he came to the crown the King of France was lord of scarcely more than the ancient duchy of France, the rest of the great duchies and counties were his almost independent vassals. It was even worse than this, for the great western states of France all belonged to England, and the chief eastern states to the Empire of Germany, while Aragon claimed Provence. The king held only the centre and the north. By the close of his reign Philip made all these rival crowns pale before his own, and the king's authority for the first time was felt from the Scheldt to the Mediterranean, and from the Rhine to the Atlantic.

Only fifteen years old at his accession, his first duty was to make peace with Henry II. of England to gain time. Then under religious pretext he set on foot a bitter crusade against the Jews, the real object being to acquire treasure by confiscation of their goods. A marriage with the heiress of Flanders brought him Amiens and other towns of the north as a dower. A quarrel with the Count of Flanders enabled him to seize the county of Vermandois (1185). He was now strong enough to ally himself with Richard Cœur de Lion, to whom he betrothed his sister Alice, and to quarrel with Henry II. (1187), supporting Richard in a parrieidal war; the same war which is memorable to Englishmen as breaking the heart of the old king so soon as he heard that his favourite son John was among the conspirators.

Now came the Third Crusade (1188). Richard of England and Philip of France, rivals in youth, in power, and in ambition, eagerly joined in the holy war. Philip took the cross at St. Denis, 24th June, 1190, next Richard at Vezelai, 4th July, wintered in Sicily, 1190–91, arrived before Acre, 13th April, 1191. The Emperor Barbarossa (Frederick I.) was to have been the third to these great leaders, but he was drowned in crossing a stream in Asia Minor. Meanwhile no one was present to curb the ambitious rivalry of the lords of England and France, with the result that in a short couple of months things were at such a pitch that Richard annoyed Philip by his superior feats of arms, while Philip enraged Richard by treating him as a vassal on account of his dukedoms of Normandy, Aquitaine, &c. When it was evident that a few days more would bring them to actual blows Philip, with his usual cautious dexterity, solved the question by refusing to France, leaving Richard in sole command, and promising to guard his English and French rights for him "like a brother" (November, 1191). The result was, as we know, that Richard fell into the hands of Leopold, duke of Austria, his mortal enemy, while returning from Palestine after the crusade, and was imprisoned by the emperor, Henry VI., in Dietsstein. Philip ill kept his knightly oath. He applied to the Pope to be released from it as soon as he knew Richard was safe in prison, nor did the Pope's indignant refusal much concern him. He joined John, Richard's traitorous brother, in promising the emperor large sums to hold his prisoner fast; but all Europe was aflame at the injury to the hero of the crusades, and Richard was quickly released under a heavy ransom. John made haste to submit to the angry king, his brother, so that Richard was able swiftly to turn on the traitorous Philip, continuing the war with varying fortunes till just before death overtook him at Chalus in 1199, while he was bringing a recalcitrant vassal to book. A month or so before he had signed a five years' truce with his great enemy.

Philip now saw his opportunity. He eagerly embraced the claim of Arthur, son of John's elder brother Geoffrey (now dead), and when John had caused Arthur to be put to death (1202) he cited him before his peers for the crime (1203). John was condemned to death by them (in his absence of course) and all the French territories of England were declared confiscate, Normandy, Brittany, Guienne, Maine, Anjou, and Touraine. Philip thus nominally acquired half of France at one blow, and quickly made himself the actual master of all of it but Guienne, which resisted his efforts (1201). The quarrel of John with the Pope, which now arose, and the consequent interdict laid upon England, were worth whole armies to Philip, and the latter was on the point of invading England as the ally of the barons and the champion of the church (and who can say what the result of that would have been), when John slavishly submitted and gave his crown into the hands of Cardinal Pandolphus in 1218, receiving it again as the Pope's vassal. On this—the deepest disgrace ever suffered by the crown of England—Pandolph stayed the

crossing of Philip's fleet. But two years later John had sworn to the Great Charter (*MAGNA CARTA*), and had broken his oath in a month or so afterwards, so soon in fact as the barons had retired. Philip therefore renewed his overtures to the English barons, but they, now seeing their danger, refused to invite Philip himself, offering the crown to his son Louis instead. He, with an army, though against the advice of his father and the commands of the Pope, crossed into England, was welcomed by the barons, and became master of all the south of England (April, 1216). But John advancing from the north to meet his foes sickened and died; the barons at once rallied to the cause of his infant son (Henry III.), and Louis, deserted, reluctantly returned to France (1217), forced to quicken his steps by the valiant exploits of the brave Hubert de Burgh.

In 1214, when foiled in his own attack on England, Philip Augustus consoled himself with a war in Flanders. Count Ferrand of Flanders, as soon as he knew his danger, allied himself with John of England and Otho IV. of Germany; but Philip had the honour of defeating the three allied armies at Bouvines, between Lille and Tournay (1214), raising the reputation of the French arms to its highest point. It was, in fact, this victory, by crushing John's power abroad, which permitted the barons to compel him to sign the charter at home. See JOHN.

Philip suffered the usual lot of the kings of France as to excommunication. This occurred when he married his third wife, Agnes of Meran, in 1196, while his second wife, Ingeburga of Denmark, married only three years before, was still living. He purchased his release by an ample and speedy submission.

The Fourth Crusade (1202-4) took place in this reign, with all the circumstances of the capture of Zara by the Venetians and the foundation of the Latin Empire of Constantinople. The crusaders never reached Palestine, and Philip took no personal part with them. Returning to France the energies of the crusaders, led by Simon de Montfort, were turned by Innocent III. against the heretic ALBIGENSES in a terrible home-crusade, whose horrible and revolting cruelties Philip encouraged, and which lasted until 1213. A second similar crusade came later (1226-29). A more beneficent crusade, that against ignorance, marked the last years of Philip's reign; he fixed the privileges of the famous University of Paris in 1200, and in this sense was its founder. In a few years it became, with his help, the finest school of Europe. The king died at Nantes in 1223, having doubled or trebled the power of France and leaving an immense treasure behind him. Part of this was found to be left to the church, and part also to the crusades. Philip II. was succeeded by Louis VIII.

PHILIP III. OF FRANCE, surnamed *le Hardi*, was the eldest son of St. Louis (Louis IX.), and was born in 1245. He was proclaimed king in the camp before Tunis, which city his father was besieging at the time of his death, August, 1270. It was Philip III. who in 1274 ceded the county of Venaissin in France to the popes as a temporal possession. He reduced the power of the nobles, but was not successful in his foreign policy. He died at Perpignan in 1285, during an attack or so-called crusade against Spain. The reason of his surname is quite obscure.

PHILIP IV. OF FRANCE, better known as Philippe le Bel, son of Philippe le Hardi, by his first wife, Isabella of Aragon, was born 1268, and succeeded his father on the throne of France, October, 1285, having previously acquired, in right of his second wife Jeanne, the crown of Navarre. It is curious to note that in 1287 at Paris, he received the homage of Edward I. of England for his French fiefs. The young king gave, from the first, his confidence to the lawyers, who were gradually working the overthrow of the feudal system. In this as well as in his rapacious exactions his policy nearly resembled that pursued at a later period by our own Henry VII., like whom his chief

objects were to amass wealth and depress the power of the nobility.

Following the lead of Edward of England, Philip banished the Jews in 1290, but merely as a pretext for seizing their wealth; a manoeuvre he repeated with signal success and still more lucrative results against all the Italian merchants in France the next year. He suppressed the Knights Templars seventeen years later, with the same motive of greed, seizing their vast wealth, the shameful charges brought against the order having the slenderest possible basis of fact. All the Templars were flung into prison on the same day in 1307. Worse still, he declared himself about to undertake a crusade, and obtained the papal order to levy a crusade tax. But he simply kept the money and stirred not, while Acre fell and the last Christian was driven out of Palestine. Over a trifling mercantile dispute Philip cited Edward of England to appear before him in 1294, and on his refusal declared forfeit the English fiefs in France. At the intercession of Pope Boniface VIII., however, the war which ensued was quickly brought to a close. A war against Flanders, undertaken when through treachery the count had fallen into Philip's power, was deservedly unsuccessful. The king was therefore in the worst possible temper when Boniface VIII. put forth his serious papal pretensions as to the rights of investiture, taxation of the clergy, supremacy of the Pope over the king, &c. He even went so far as to send his henchman William of Nogaret to seize the person of the Pope. This was roughly done; and the old man of eighty-six succumbed under the brutal treatment. Philip stood so strong with the conclave that he was able to undertake to get a Frenchman (Bertrand de Goth) elected as his successor upon his own conditions, one of them being the public disgrace of the memory of the hated Boniface as a heretic. The cardinal, who agreed to the shameful compact, was indeed elected as Clement V. (1305), and Philip quietly kept him a prisoner in France, allowing him to reside in the French papal territory of Venaissin, to which soon was added the town of Avignon. The unhappy pope had first to assist Philip by the mockery of the condemnation of the Templars, and when after seven years' imprisonment and frequent torture the heroic Du Molay, the grand master of the order, was burnt at the stake in Paris, with two other victims, all men shuddered to hear Du Molay's summons to king and pope, to meet him before the Eternal Judge in that same year. Men shuddered still more when the tyrant and the faithless priest actually followed their victim to the grave within a few months (1314).

Philip never got his promised vengeance on his foe Boniface VIII. Clement V. managed after many delays to buy him off with new bulls and new readings of old bulls about the questions at issue, and with a plenary amnesty to all concerned in the scandalous outrage which led to the death of Boniface. A process was held and many witnesses examined, but the heresy was held to be not proven.

Philip was detested and feared in France; his tyranny was crushing in its severity. He earned the name of "the Coiner" by his repented debasement of the currency, and then he shamelessly refused to accept for the royal dues the debased money except at the actual (not the nominal) value. At the close of his days he turned his severity towards his own family; and he imprisoned all his three daughters-in-law on a charge of adultery, their paramours being *flayed alive* (1314). And yet, on his deathbed, which swiftly followed, he exhorted his sons to piety, clemency, and justice (November, 1314). All his three sons reigned in turn (Louis X., Philip V., Charles IV.) and the detested direct line of Capet then died out, crushed by its own vices, the Valois branch coming to the crown in the person of Philip VI. It was in the reign of Philippe

le Bel that the Tiers Etat, or Commons, were admitted for the first time to take part in the national assemblies designated *Etats-généraux*, or States-general.

PHILIP V. OF FRANCE, known as Philippe le Long, the second son of Philip IV., was born 1294. It was upon the occasion of his succeeding his brother Louis X., who left a daughter (1316), that the SALIC LAW, by which females were excluded from the succession to the throne, was established by the States-general as a constitutional law in France. Philip bitterly persecuted the lepers and the Jews in 1321, under the horrible accusation of their having poisoned all the wells in the kingdom. He filled the land with slaughter, in the midst of which he died, 3rd January, 1322.

PHILIP VI. OF FRANCE, usually called Philippe de Valois, was son of Charles, count of Valois, a younger son of Philip III. He was born 1293, and succeeded Charles IV. in 1328. Although Charles's widow gave birth to a princess, a parliament was called to pronounce on the succession, and for the third time in twelve years the SALIC LAW was enforced, excluding women from the throne of France. To strengthen his claim, Philip VI. had married in 1313 Jeanne of Burgundy, only daughter of Louis X., brother and predecessor of the late king. During this reign the war with Edward III. of England broke out, in 1337. Edward III., who was the son of Isabella, the sister of the three previous kings, refused to recognize the Salic Law, and assumed the title of King of France; and after gaining other advantages, he defeated the French king at Crécy (1346). Crécy is especially memorable as the first great battle wherein cannon were used, exclusively or chiefly on the side of the English king. Philip also lost Calais (1347), and was unsuccessful on the side of Guienne and Poitou (1345-47). A dreadful pestilence, which swept away a third part of his subjects (1348), filled up the measure of his adversity. He died 22nd August, 1350, in the fifty-seventh year of his age. The terrible salt-tax called the *gabelle* was among the many imposts invented by the tyrannical Philip IV. (1286); but it first assumed a crushing weight under Philip VI. in 1310. It continued to oppress France until the Revolution swept it away in 1790. This king acquired by purchase (in 1319) from the Count Dauphin, Humbert II., the province of Dauphiné, which ever afterwards was the appanage of the eldest son of the king; so that the Counts Dauphin thenceforth (called for shortness Dauphins simply) exactly answered to our Princes of Wales.

PHILIP (*Felipe*) was the name of five kings of Spain.

PHILIP I. OF SPAIN, or rather of Castile, was born at Bruges, 1478, and became Count of Flanders on the death of his mother, Mary of Burgundy, in 1482, and Duke of Burgundy in 1493. He married the Infanta ("Crazy Joan"), the daughter and heiress of Ferdinand and Isabella, in 1496, and on the death of Isabella in 1504, assumed the title of King of Castile (her kingdom), Ferdinand still reigning as King of Aragon. The conspiracy between Ferdinand and Philip to make the most of the brain troubles of the Queen Juana for their own dynastic purposes was a very cruel one. When in 1506 the husband died who had treated her so badly, and against whom she had once or twice appealed to her subjects, the poor queen's distraught brain gave way altogether, and she refused to leave the side of the coffin. The son of Philip and Juana was Charles I. of Spain, better known as the Emperor Charles V. of Germany.

PHILIP II. OF SPAIN, and Philip I. of England, was born at Valladolid, 1527. He was the son of the Emperor Charles V. (Charles I. of Spain). He was named King of Naples in 1554, and in the same year married Mary I., queen of England, 25th July, at Winchester. Philip never cared in the least for his wife. He was a gloomy bigoted fanatic, and his sole object beyond the

hope of enlarging his vast possessions, lay in the gain of Protestant England, which he aided Mary to restore swiftly to the bosom of the ancient church. Mary, a weakly sickly woman, seems to have been fascinated by Philip's austere gloom, and to have longed desperately for the love of her husband. As for the prince, he soon discovered that the English would be very impatient under any attempt at foreign domination, or even at his formal coronation as king, and he left his new-made bride after a stay of only two months, September, 1555. The unhappy queen never, till the very last, quite gave up the hope of making England friendly to Philip. It is pathetic to see, even in the coinage, how his profile is found on the one side and hers on the other, and the names are given as joint sovereigns, while on the Mary shilling a unique pose was adopted, which has never been repeated, for the heads of the king and queen were set face to face on the obverse of the coin, almost as if they were about to kiss. In October, 1555, Philip became sovereign of the Netherlands on the abdication of his father, and on a like abdication with regard to Spain he succeeded to that crown in 1556. In 1557 he paid a brief visit to England to induce Mary to declare war against France, the result of which was that we lost Calais, the last English possession in France, January, 1558. Philip, however, had been victorious in person at St. Quentin, August, 1557, and the Count of Egmont won for him another victory in July, 1558. The peace of Chateau Cambresis terminated the war in 1559. As Mary of England had died in 1558, and her half-sister and successor had refused the overtures of Philip, the latter married Isabella of France to cement the new alliance. His talented sister Margaret, duchess of Parma, was from 1559 to 1567 regent of the Netherlands for her brother, who returned to Spain to build the gloomy Escorial (founded in 1563), to transfer the capital of Spain from Toledo to Madrid, to imprison his son Don Carlos (and perhaps worse, for the prince died in six months), and to immerse himself in the solitude of an arch-plotter. He may be said henceforth to have devoted himself to persecution. The Inquisition was set fiercely to work, he himself assisting at the *autos da fé*, a persecution of heretics was vigorously conducted in Naples in 1561, and another of the Moors in Spain in 1565. Similar severities in the Netherlands caused Margaret to resign, and drove the provinces into revolt in 1567, and Philip soon learned that no small assistance was being lent to the insurgents by England. He at once began to prepare a great revenge. The kingdom of Portugal fell into his hands in 1580, and all the additional power thus gained was welcomed as the mighty armament grew. At last in 1588 Philip had the joy of knowing that the Invincible Armada had started, and no doubt in a few months would bring the haughty little island into vassalage. The wonderful tale of ruin of that great fleet is elsewhere told. [See ARMADA.] Foiled in open warfare, Philip did not scruple to resort to assassination, and repeated attempts were made on the life of Elizabeth about 1593-94, at the same time that his agents were hard at work against Henry IV. (*Henri Quatre*) in France. The two hated rivals lived and were adored by their subjects, however, whilst Philip, solitary, detested, beaten, and disgraced, his fairest provinces (the Netherlands) for ever gone, sank into the grave most miserably, appropriately breathing his last at the gloomy Escorial, 13th September, 1598.

PHILIP III. OF SPAIN, born at Madrid, 1578, succeeded his father, Philip II. in 1598, and reigned till 1621. He had to recognize the independence of the United Provinces of the Netherlands in 1609. This king expelled all the Moors from Spain in 1610.

PHILIP IV. OF SPAIN, born at Valladolid in 1605, married Isabella of France, 1616, while yet a child, and succeeded his father Philip III. in 1621. This was the

king whose sister Charles of England (afterwards Charles I.) was to have married, in pursuance of which scheme the prince and the Duke of Buckingham visited Madrid in 1623, the result being an insulting refusal of the infant by Charles, an open breach between the two countries, and war with England in the following year. The personal appearance of Philip IV. is better known to us than that of any prince of the time, except our own Charles I., for while the pencil of Vandyck has preserved the features of the one, the still more marvellous portraiture of Velasquez has immortalized the other. Two superb portraits of Philip IV. by Velasquez are in our own National Gallery, and of one of these it is often said that it is the finest portrait in the world. It is unnecessary to say (since Philip was of the house of Austria) that its beauties lie in the painter's art and not in the subject's lineament. Philip IV. spent a life of pleasure, leaving the task of ruling Spain to his minister, Gaspar Guzman, count of Olivarez, whose administration was disastrous. In 1640 Portugal revolted and separated from Spain, and in 1647 Naples rose for a short time under Masaniello. A formal renunciation of the Netherlands was exacted from Philip IV. at the peace of Westphalia (1648). Peace was finally made with France, with whom Philip had waged more than one war, in 1659 (peace of the Pyrenees); and an interview with the young King Louis XIV. shortly afterwards, conducted with great splendour in the mid-stream of the Bidassoa, led to the marriage of Louis to the daughter of Philip, under the condition that France should under no circumstances advance a claim in consequence to the throne of Spain. Nevertheless, upon Philip's death in 1665, Louis at once put in a claim for the succession of Flanders, on the flimsy pretext that the queen's promised dowry never having been paid he was released from his oath of renunciation. The claim being resisted he took the field in person, Turenne and Vauban being with him. Charles II. of Spain was still a minor, and was the child of a second marriage, the Queen of France being a child of the first. The war, shamefully undertaken, was gloriously carried on, and terminated at the peace of Nimeguen in 1678, greatly to the profit of France.

Not content with this breach of faith, Louis XIV. did far worse. When the crown of Spain was evidently about to fall of direct heirs on account of the childlessness of Charles II. (half-brother of the Spanish Queen of France), he procured the making of a will by that king which left the crown to Philip, duke of Anjou, grandson of Louis XIV., and second son of the dauphin. Charles II. of Spain died in 1700, and Philip, through French intrigues backed with heavy bribes, was received as his successor. His grandfather launched the proud boast, "The Pyrenees no longer exist."

PHILIP V. OF SPAIN, the first of the Spanish line of Bourbon, was born at Versailles in 1683, and ascended the throne of Spain in 1700 under the circumstances named above. A league was at once formed by the emperor, England, and Holland to dethrone him. The great War of the Spanish Succession broke out, and Europe was ravaged from 1701 till 1713, when the peace of Utrecht at last recognized Philip V. as king of Spain among its many other provisions. It was felt that the price of the splendid victories of Marlborough and of Prince Eugène was quite thrown away by this foolish and disastrous peace, brought about purely by Tory intrigues in England, directed towards a possible Stuart succession to a dying Anne. It was in this war that Gibraltar was won by Sir George Rooke in 1704. After the death of his first wife Mary Louisa of Savoy, Philip V. married Elizabeth Farnese (1714). Her influence over Philip amounted to fascination. The whole matter of the methods physical and other she used towards him affords material for some of the raciest passages from Carlyle's

pen ("Frederick the Great"). Carlyle nicknames the queen, not without reason, the *Termagant*; and for many years she succeeded in plunging Europe into war chiefly on the question of an appanage for her son Carlos. The first minister in her countless plottings was Alberoni, and his intrigues brought about the *Triple Alliance* (of England, Holland, and France), 4th January, 1717. In the next year this alliance was joined by the emperor also, making the *Quadruple Alliance*, whereon Spain attacked the Sicilies, and England took its share in the war with that famous victory of George Byng over the Spanish fleet off Cape Passaro (1719), which gained him his peerage as Lord Torrington. This brought about peace in 1720, and a congress met at Cambrai to settle the whole question. A private arrangement between Spain and the Emperor Charles VI. (1725), which was to take effect at his death, drove England, France, and Prussia, for mutual protection, into the treaty of Hanover (3rd September, 1725). Out of this grew the second war with Spain and the great siege of Gibraltar, from January to May, 1727, peace being finally declared May, 1728. Later on, at the treaty of Seville (1729), France and England undertook to settle the question of the appanage in due time in Carlos' favour, which indeed in 1731 they accomplished, and he was installed as Duke of Parma and Piacenza. In two years, however, Spain was again at war with the emperor, for the ambitious queen saw her way to the crown of Naples for her son—and this too was accomplished in 1734 through a vigorous attack by Don Carlos in person. He was now eighteen, and not without military talents. He was crowned king of the two Sicilies at Palermo, 3rd July, 1735, and confirmed by the peace of Vienna, signed in October following. The restless "Termagant" now set to work to find an appanage for her other son Philip, and from 1742 to 1748 she never ceased to keep Europe in discord, striving to regain the duchy of Parma for him, although Carlos had renounced it on becoming King of Naples. Philip did indeed become duke in 1748, and was ancestor of the succeeding Bourbon dukes till 1859, when the duchy, by the treaty of Villafranca, became part of Italy.

As early as January, 1724, the settled melancholy of Philip led him to renounce the crown in favour of his eldest son Louis by the first marriage; but the latter died in a few months, and the unhappy king resumed his royal crown. He was quite unable even to sit at the council table, and often refused to eat. In these miserable circumstances, the singer Farinelli arrived in Madrid (1736), and the queen caused him to sing, not before the king, for that would have been impossible, as the king received no one, but in a room near by. Philip was entranced, sent for the artist and bade him name any reward for his wonderful and healing art, however great a sum he might choose. Farinelli, acting under instructions, skillfully replied that his greatest reward would be to see the king return to his usual habits and resume the crown. Philip agreed, providing Farinelli aided him. Thus arose this strange compact between a singer and a madman to rule the kingdom of Spain, ratified in a formal way by the king consenting to be shaved for the first time for months. Farinelli received a magnificent salary, and for ten years, until the king's death, he sang every evening before the king, repeating the same four songs which had brought about the alleviation of the poor man's misery. No alteration or substitution was possible, and these works must have therefore been performed at least 3600 times. When Philip died, 9th July, 1746, his son Ferdinand VI. succeeded; but Ferdinand also went melancholy mad, and Farinelli was his only doctor, and indeed his chief minister for the thirteen years of his reign. In 1759 the "Termagant" (who still lived, and indeed lasted on till 1766), rejoiced at seeing her son Don Carlos become King of

Spain on his half-brother's death; but she may also have reflected that all the misery and bloodshed she had caused to secure him a crown had been needless. Thus Carlos, as king of Spain, became ancestor of the present Bourbon house of Spain, and as king of Naples (which he resigned to his son Ferdinand on acquiring Spain) he became ancestor of the Bourbon house of Naples which Garibaldi drove out in 1860.

PHILIP, JOHN, an English artist specially excellent in pictures of Spanish life, was born in 1817 and died in 1867. He twice resided in Seville, and thoroughly caught the national characteristics of Spain, the brilliant colouring, the glare of sunlight, and the open-air life.

PHILIP THE BOLD, first Duke of Burgundy, of the second and last house of that duchy, was born in 1312, being the third son of John II. king of France, and his honourable sobriquet was won by his efforts as a lad of fourteen to save his father at the disastrous battle of Poitiers. His faithfulness did not rest there, but he shared his father's captivity in London when he fell into the hands of the Black Prince. Returning to France he was soon after named Duke of Burgundy (1363). Subsequently he married Margaret of Flanders, and thus acquired those rich provinces which were the backbone of the great wealth and power of his house. He had to quell the proud burghers of Ghent at Rosbeck (1382), where 26,000 of them lay upon the field before his authority was fully admitted. Afterwards, however, his subjects acknowledged his excellent character and wise government, and his reputation grew so high that the affairs of France were intrusted to his hand when his brother (Charles VI.) became imbecile. He died combating the English advance, in 1404.

PHILIP THE GOOD, Duke of Burgundy, was the grandson of the above, and was born at Dijon, the capital, in 1396, succeeding his father, John the Fearless, in the duchy, on the assassination of the latter at the bridge of Montreuil under the very eye and by the orders of the Dauphin Charles himself (1419). The young duke, ontaged beyond measure at the foul crime, aided Henry V. of England to gain possession of France; but ten years later he was prevailed on to make peace with his old enemy, now Charles VII. It was soon broken; but a second and firm peace was signed in 1435, with the result that the English were very speedily driven from France. Under Philip great acquisitions to Burgundy were made in the Low Countries, and his state, though not regal in title, was under his wise guidance by far the wealthiest, the most brilliantly splendid, and the most powerful in Europe. He died in 1467. He sheltered the Dauphin Louis, afterwards Louis XI., when bitter quarrels amounting to civil war broke out between him and his father; he himself being often at variance with his own passionate and wilful son Charles, count of Charolais, the famous headstrong **CHARLES THE BOLD**.

PHILIPPIANS, EPISTLE TO THE, one of the canonical books of the New Testament, addressed by St. Paul to the Christian church at Philippi, the first European city visited by the apostle (Acts xvi.), is generally supposed to have been written towards the end of the apostle's captivity in Rome, *i.e.* A.D. 62 or 63. The genuineness of its Pauline authorship has only been questioned in very modern times, and the doubters have never been numerous. Baur disputed it on three grounds:—(1) the appearance of Gnostic ideas in chap. ii. 6-11; (2) the absence of anything distinctively Pauline; and (3) the questionableness of some of the historic dates. It is usually regarded as one of the most characteristic of St. Paul's writings.

PHILIPPICS, the three orations of Demosthenes against Philip II. of Macedon, 352-341 B.C. The term is now generally applied to any vigorous and impassioned invective. Cicero's orations against Mark Antony, 43 B.C., are also known by this appellation.

PHILIPPINE ISLANDS, an archipelago of about 1400 islands, forming a dependency of Spain, lying between 4° 40' and 20° N. lat., and 116° 40' and 126° 30' E. lon., and having the China Sea on the west, and the Pacific Ocean on the east. They are very imperfectly known at present, but are estimated to have a total area of 114,000 square miles, and a population of about 10,000,000. The principal islands of the many hundreds of large and small forming the group are—Luzon, Mindanao, Palawan, Mindoro, Panay, Negros, Zebu, Leyte, and Samar. They belong to the great volcanic band of the East seas; and the volcanoes are often active and earthquakes frequent. Almost all the islands have magnificent mountain scenery, and active volcanoes are specially numerous in South Luzon. All are clothed with luxuriant vegetation, and, under very imperfect culture, yield rich crops of sugar, indigo, cotton, coffee, tobacco, hemp, rice and cereals, cocoa, sago, banana, cinnamon, betel, fine fruits, and many kinds of useful and ornamental woods. Alluvial gold is found in the river beds; iron, copper, sulphur, and coal are also known. Larger beasts of prey are unknown, but reptiles and insects abound, with birds of brilliant plumage.

MANILA, on the island of Luzon, is the seat of government and the centre of trade, though Iloilo and Zebu, also ports open to foreign trade, are proving of importance. Tobacco, the chief export for long, only permitted to be freely cultivated, but purchased by the government at its own price and paid for at its own time, ceased to be a monopoly in 1882. The tropical character of the climate, combined with the humidity of the atmosphere, renders it impossible for Europeans to engage in active work with safety.

The mean temperature of Manila is about 82·6° Fahr. The range seldom exceeds 15 degrees. In some parts of the interior the temperature is much lower, marking 50 degrees in the mountains of Luzon. Indeed, were roads opened and sanitoriums established in the coolest places, the European's life in the Philippines would be much ameliorated; since it is not the absence of change of temperature, but the impossibility of taking advantage of it, which drives invalids to Europe.

The seasons may be divided as follows:—The north east monsoon lasts during December, January, and February; the hot season during March, April, May, June; the wet season during July, August, September, and October. November is a transition month of fine weather and showers. In May and June violent thunderstorms are of daily occurrence. These two months are the most disagreeable in the whole year, the air being impregnated with electricity and heat, while the steam rising from the heated earth after showers, called by the Spaniards *vapores de tierra*, is considered very unhealthy.

Hurricanes, earthquakes, and fearful thunderstorms are the chief climatic drawbacks. Typhoid fever of a very severe type and dysentery are the prevalent maladies around Manila and its suburbs, where the population is crowded and increasing. The health-rate shows results which compare unfavourably with the earlier days.

Owing to various causes, among others probably to the fact that there has been no systematic conquest, and that slavery has never been permitted, Spain exhibits here a subject race perfectly happy and in comfortable circumstances. The "Indians," as the Spaniards call the natives, are a fine race, endowed with the lighter graces which form such a pleasing feature in the Burnese and Japanese, in wide contrast with the solemnity of the native of the Indian peninsula on the one hand, and the prosaic, toiling Chinese on the other. These Spanish Indians are passionately fond of dress and personal decoration, and are given to pleasure. To a certain point they will work, but they are improvident and devoid of ambition, spending their earnings freely and taking no thought for the morrow.

Their necessary wants being infinitesimally small, a poor member of a family is no appreciable burden, and, consequently, there are no signs of poverty or pauperism among them. There is much sympathy between the Indians and the Spaniards, and intercourse between the two races by no means entails the social degradation of the children which it does in India. The mestizos of the Philippines are a more fortunate product than the Indian half-castes, for they usually combine the best points, physically speaking, of both parents, while the Eurasian of India is too often a caricature.

Such a people as this are eminently suited for Spanish rule, which, so far as the provinces are concerned, means the personal rule of the priests. The true aborigines are not the 6,000,000 of Malayian Indians. In the mountains and the less habitable parts of the islands are several tribes of savages who have not been brought within the government of the priests. The Negritos are a woolly-headed people of the true African type, who live on roots and wild fruit which require no labour. They are harmless and docile. The Iggrotos, a straight-haired tribe, fierce and untamable, inhabiting still more remote parts of the jungle, are very little known to the Spaniards. Indeed, with the exception of the island of Luzon, the Philippines remain a virtually unexplored country.

The Chinese population amounts to about 50,000, nearly all being males; their repugnance to bringing their women from China accounts for the fact of there not being more than about a score of Chinese females among them. They go by the name of "Sangleys," which signifies travelling salesmen, and come chiefly from Macao. They are chiefly engaged as coolies, artisans, and shopkeepers.

Though to English notions the mode of government established by the Spaniards may not seem calculated to promote the well-being of any community, there can be little doubt that it is remarkably adapted to the difficulties to be met in the Philippines. The governor is appointed for three years, and is to a great extent independent of the home authorities. Each province has a European over it, called the Alcaide, who has a native authority called the Gobernadorcillo or little governor under him. These authorities would be utterly inadequate to control the native races were it not for the strange patriarchal power of the friars of the various religious orders. Large churches and convents are the landmarks of the rural districts, and such an ascendancy have the parish priests gained over the native mind that the traveller may often find populations of 5000, 10,000, or 20,000 inhabitants ruled over peacefully by one old man, who, with his doors wide open night and day, lives and sleeps in perfect security. Everywhere the natives have become accustomed to live under his benevolent rule, and repose entire confidence in him. Master by these means of their wills, nothing is done without his approval. The Indian local governor, on receiving an order from the alcaide, carries it at once to the convent. The priest settles or directs all lawsuits of the people; he draws up documents, goes to the capital as advocate for his Indians, opposes his prayers to the occasional violence of the "alcaldes mayores," and rarely fails to obtain his end.

History.—The Philippines were discovered by Fernando Magalhães in 1521, in the reign of Philip II., after whom they were named; and in 1564 the Spaniards made a settlement on one of the islands, and founded Manila in 1571. They obtained the possession of this important group almost without bloodshed; and they have preserved it by the extensive diffusion of the Roman Catholic religion among the Malays, who form the greater part of the population. The Spaniards have retained the island ever since, except from 1762 to 1764, during which the English held Manila, and for the release of which the Spaniards paid a ransom of £1,000,000.

PHILIPPINES, NEW (more properly called *The Carolines*), are a group of islands lying between New Guinea and the Ladrões, and stretching from 3° to 13° N. lat., and from 138° to 164° E. lon. The islands in this tract of the Pacific are very numerous. Most of them are small, and lie within coral reefs; the produce of these is chiefly limited to cocoa-nuts and bread-fruit. Such as are isolated are in general high towards the shore, some of them rising to an elevation of 1200 feet above the sea; but like the smaller islands, they slope away towards the centre, each presenting a narrow strip of land encircling a lagoon. The natives make excellent mats and large canoes, in which they fish with great industry and undertake long voyages. The population of the group (including the **PELEW ISLANDS**) is estimated at 24,000. The climate is mild and agreeable throughout. The Carolines were discovered by the Spaniard Lopez de Villalobos in 1543, and were so named in honour of Charles II. Although nominally belonging to Spain they had no settlement on the islands until 1885, when Germany claimed possession of them. The dispute was referred to the Pope for arbitration. He decided in favour of Spain, but allowed the Germans the right to establish a coaling station on the islands.

PHILIPPOPOLIS, the capital of Eastern Rœmelia, situated 90 miles W.N.W. of Adrianople and 309 from Constantinople, on the Maritza, which is navigable up to the town. It was almost entirely destroyed by an earthquake in 1818, but it soon recovered, and is now a well-built, clean place, and a most important commercial centre, with manufactures of woollen, silk, and cotton stuffs, &c. There are numerous mosques, several Greek and Bulgarian churches, and a Roman Catholic church. It was founded by Philip, father of Alexander the Great. The population is 25,000.

PHILIPS, AMBROSE, born about 1671, of a good Leicestershire family, was educated at St. John's College, Cambridge. His first printed performance was a copy of English verses in the collection published by that university in 1695. From this date nothing is known of him except a "Life of John Williams, Archbishop of York" (the zealous opponent of the famous Archbishop Laud), published in 1700, till the appearance of his six pastorals (1709), in the same part of Tonson's "Poetical Miscellanies" as the pastorals of Pope. Philips' next work was his "Letter from Copenhagen" (in verse) to the Earl (afterwards Duke) of Dorset, dated 9th March, 1709, which was printed in the twelfth number of the *Tatler* (7th May, 1709), with an introductory enlogium by Steele. He afterwards translated the "Persian Tales" from the French for Tonson. The next event of his literary life was the production at Drury Lane, in February, 1711, of his tragedy of the "Distressed Mother," which, though little more than a translation of the "Andromaque" of Racine, was received with great applause, and long continued to keep possession of the stage by the constant praise of the authoritative Addison. In fact had it not been for the favour of Addison, somewhat over-proud of his great power in this way, Ambrose Philips would scarcely be remembered. True, his pastorals are more natural than those of Pope, but then Pope's pastorals are juvenile works and immeasurably beneath his later productions in merit. But the effect of the political and personal friendship of the staunch Whig comrades, Addison and Philips, as manifested in the constant laudation of the latter by the Addison literary set, was to rouse a fierce animosity in the bosom of Pope. Pope never forgave an injury of this sort. Determined to oust this rival from the public favour while unwilling to do the deed himself, he waited till 1725, when Philips had opened a new vein of poetry about children (1724), written in a pretty baby-language, and therefore open to easy ridicule, and then handed him over for vivisection to Henry Carey, the author of "God save the Queen" and "Sally in our Alley." The result was perhaps,

the finest literary slaying-alive of which our language can boast; and Ambrose Philips never dared hold up his head in literature again. He named his enemy, and hung up a rod in "Button's" to thrash Pope with if he appeared; but he sank beneath the flood of ridicule, whilst the witty poison which had killed his literary career raced through edition after edition.

Philips profited well by his friendship with the Whigs. He was paymaster of the forces, a commissioner for various things, and then crossing to Ireland as secretary to Boulter, the primate, he stood for Armagh, entered Parliament, was named secretary to the Lord Chancellor of Ireland and registrar of the Prerogative Court. He died of apoplexy 8th June, 1749.

PHILIPS, JOHN, author of the best piece of burlesque writing in our literature, was born in 1676 at Bampton, in Oxfordshire, where his father was vicar. He was a delicate boy, and when at Winchester School, and unable to share in the rough school ways, he read Milton until he was thoroughly saturated with the Miltonic style. In 1694 he went to Oxford, and added an equally extraordinary knowledge of Virgil to his extraordinary knowledge of Milton. His imitations of both poets made him famous in the university. One of these, a playful suggestion to an extravagant friend of the many virtues of a shilling in the pocket, called "The Splendid Shilling," was read everywhere, stolen, printed, and plagiarized. Philips arrived in London with a high reputation for wit; and in 1705 Harley and St. John commissioned from him a poem, in blank verse and in the Miltonic style, on the subject of "Blenheim" as a counterpoise to the "Campaign" of Addison commissioned by the opposite political party. Philips's "Blenheim" is to many moderns more agreeable than Addison's. He now corrected, finished, and published the immortal "Splendid Shilling, an imitation of Milton," which has delighted so many generations by its polished wit, and is as fresh as the day it was written. The next year (1706) John Philips published, also in blank verse, a capital imitation in English of Virgil's Georgics, called "Cyder," which received the honour of translation into Italian. He now prepared seriously to aim at the highest forms of literature, since his power over versification was consummate. The subject chosen was the Resurrection. But the necessary application put too great a strain upon his delicate frame, and he died of consumption in February, 1708.

PHILISTINES, a people of Palestine, who dwelt on the sea-coast to the south-west of Judaea, from Ekron towards the Egyptian frontier, and contiguous to the tribes of Dan, Simeon, and Judah. Their origin is uncertain, and their name is probably derived from a Semitic root meaning to wander. They seem to have established themselves in Palestine about 1800 B.C. In the time of Joshua we find them divided into five independent provinces, Gaza, Askelon, Ashdod, Gath, and Ekron, each governed by its own prince. After various wars with the Sidonians and Egyptians, they directed their united strength against the Jews, conquered Israel, 1156 B.C., and ruled over it for forty years. They were defeated by Samuel about 1120 B.C., and by Saul and Jonathan in 1087 B.C. David completely subjugated them in 1040 B.C. They were, however, still powerful, and Solomon felt obliged to construct forts on the frontier to protect his kingdom from their incursions. In the wars between Assyria and Egypt, Philistia was the battlefield of the two powers. During the Babylonian captivity the Philistines sought to revenge themselves on their old enemies, the Jews; but a change took place after the return, and the fraternizing of the two races was a scandal to the more strict among the Jews (Neh. xiii. 23-25). From this point the history of the Philistines is lost in that of the neighbouring nations.

The religion of the Philistines was of the old Semitic

type. Their chief male god was Dagon, the name which seems to come from fish, and there is little doubt that he was represented as half man and half fish. He was worshipped chiefly at Gaza, but also had a temple at Ashdod. The female deity, Ashtoreth, had a temple at Askelon. She was represented with a human head, but her body continued in the form of a fish. Balzebub ("Fly-Baal"), another deity, was worshipped at Ekron.

The name Philistines was applied by Heine and the German liberals, about 1830, to all opponents of progress; and Matthew Arnold introduced it into English literature.

PHILLYREA is a genus of plants belonging to the order OLEACEÆ. It contains evergreen shrubs and trees, introduced from the shores of the Mediterranean, many varieties of which are cultivated in parks and gardens for the sake of their shining dark-green opposite leaves and the fragrance of the numerous inconspicuous greenish-white flowers growing in axillary clusters. The opposite leaves distinguish Phillyrea from Alaternus, to which these plants present much resemblance. The Phillyreas were introduced into England at the end of the sixteenth century.

PHILO (properly **PHILON**), **JUDEUS**, so called to distinguish him from others of the same name, was born at Alexandria a few years before the birth of Christ. He was held in such estimation by the Jews, that he was chosen to preside over an embassy sent to Rome, 39 or 40 A.D., to appeal against the demand of the Emperor Caligula that divine honours should be paid him, and the embassy not only proved fruitless, but Philo and his companions were compelled hastily to escape from the proximity of the famous madman who then wielded the sovereign power at Rome. Fully conversant with the knowledge of that period, he devoted his highest powers to the study of philosophy, his aim being to find, enshrouded in the religious system of Judaism, the loftiest speculations of Platonism. In pursuit of this end he adopted an allegorical system of interpretation of the Old Testament scriptures, and by this means endeavoured to show that the highest conceptions of the Greek poets or philosophers might be found implied in the law of Moses. The distinction of Philo is his thoroughgoing Judaism as against this weakening Alexandrine tendency, and yet so Hellenized had the Jews become that Philo himself knew the Bible only in its Greek dress (Septuagint), being ignorant of Hebrew. In Philo's hands the tendency towards a threefold view of God and the world grew clear, especially his famous doctrine of the *Logos*. Many parts of his doctrine are the subject of keen discussion among modern scholars, but it has been clearly established that his influence both upon Christianity and Judaism has been of vast extent. Some of the developments of the teaching of Philo will be found noticed under Gnosticism and Neo-Platonism.

There have been numerous editions of the works of Philo, the *editio princeps* by Turnebus dating from Paris in 1562. This after being several times reprinted was superseded in 1742 by the edition of Mangey (two vols. folio, London). Among the later editions are those of Richter (Leipzig, 1828-30); and Tauchnitz (1851, &c.); while an English translation of Philo in four vols. has been published in Bohn's Ecclesiastical Library. See also Ewald's "Geschichte des Volkes Israel" (vol. vi., 1868), and Keim's "Geschichte Jesu von Nazara" (vol. i. English translation, 1873).

PHILOKTETES (Lat. *Philoctetes*), in the Greek mythology, was one of the heroes of the Trojan War. He had been a friend of Héraklēs, and had attended him in his last moments. It was he who set fire to the funeral pile when the hero in his unbearable agony had determined to destroy himself. In return for this service Héraklēs bequeathed to him his famous bow and the poisoned arrows. As the prince was one of the suitors of Helen he was bound by a like oath with the rest, and on her abduction by Paris

he joined the armament against Troy with seven ships. Landing on the island of Lemnos he had the misfortune to drop one of his arrows on to his foot, and the poisoned wound gave him intense agony, while a fearful stench arose from it, so that his people could not bear to approach him. Regardless of his frantic reproaches they left him and proceeded to the war, under the command of Mœdon. Philoktêtès managed to support himself during ten years alone on the island. Meanwhile the siege dragged on its endless length, until it was found by an oracle that two missing heroes were needed to lead the Greeks to victory: these were Neoptolemos (or Purrhos), the son of Achilles, and Philoktêtès, or rather the bow of Héraklès. Odysseus undertook to get both, and in his crafty way sought to induce Neoptolemos to steal the bow, while Philoktêtès, who was overjoyed to greet him, and had agreed to go with him to the war, was resting in a half-numbd slumber during one of the intervals of his agony. The young hero was at first tempted, but the final victory of his honourable feelings forms the subject of one of Sophoklès' finest plays. He bade Philoktêtès with him to Troy, and there his hurt being healed by skilful surgery, the latter became one of the foremost in the fight. It was he who slew Paris with one of the arrows of Héraklès in the final rush when the city fell.

PHILOLA'OS, the earliest expositor of the Pythagorean philosophy of whom we have any knowledge, was born either at Crotona or at Tarentum in Southern Italy. The dates of his birth and death are uncertain, but he was a contemporary of Socrates (469-399 B.C.) although somewhat younger than the Athenian sage. Plato is said to have availed himself of the researches of Philolaos, more particularly in his dialogue entitled "Timaios." We possess considerable fragments of his writings, which have been collected and carefully edited by the German scholar, Augustus Boeckh, but unfortunately it remains as yet doubtful whether they are original works of Philolaos or commentaries of a much later date. According to the Pythagorean philosophy generally, as represented by Aristotle, *number* is the principle and essence of all things, a position which, when properly explained, is neither untrue nor unintelligible. [See PYTHAGORAS.] Philolaos expresses the principle somewhat differently. The elements of all things, he says, are "the limiting and the unlimited," and out of these "the limited," i.e. the universe, is generated. The world (Gr. *kosmos*) cannot be explained by the single element of limitation, for limits require something to which they are applied, nor can it be explained by the single element of the unlimited, for the unlimited is the chaotic and inconceivable. But let these two principles combine, let limits be imposed upon the unlimited, and the ordered universe is the result. It is obvious that if we suppose things to be thus constituted we must regard them as originally unlimited, for it would be altogether futile to suppose limits induced upon what was already limited. Plato, in his dialogue entitled "Philebos," afterwards adopted and applied to moral purposes this Pythagorean doctrine of the limiting and the unlimited. The doctrine is important in the history of speculation as an early expression of that fertile truth, which is the basis of all sound philosophy, and which Hegel has done more than any other philosopher to signalize; the truth, namely, that the universe and everything which it contains is a unity of contraries—in other words, that absolute oneness (unity without diversity) is altogether inconceivable and absurd. Philolaos is the best, because the earliest authority for that one of the Greek systems of music which was invented by Pythagoras, and had for basis the octave. It is from him that we get both the names and the measurement of the Pythagorean intervals. The system he specially names *Harmonia*, from its power to reconcile and fit in (Gr. *harmonizein*) all the intervals; hence arises our word har-

mony. It is also in Philolaos that we meet for the first time with the view that the earth moves round the sun; this is generally attributed to Pythagoras, but there is no proof that it was not original on the part of Philolaos.

PHILOLOGY, in its present form, is almost the youngest, as it is certainly one of the most important of the sciences. It may be taken to mean the "science of language." Originally, however, it meant rather the "science of literature," if that expression were allowable. A *philologos* (Gr. *philos*, lover; *logos*, speech or language) was to the Greeks a professor of literature, a critic of style, a person who was well acquainted with the ancient Greek writers and with the subjects treated of in their works; and we learn from Suetonius ("De Illust. Grammat." c. 10), that Eratosthenès, who lived in the second century before the Christian era, was the first who obtained this name, in consequence of his extensive and varied learning. In Roman times a *philologus* was merely a person skilled in language, and the word became almost synonymous with *grammaticus*.

As the whole of ancient knowledge was enshrined in ancient literature, the term philology came in the dark ages, curiously enough, to include most of what we now call science, for then the only science was that of Aristotle and the Greek geometricians and philosophers. When a revival of culture set men to think for themselves, philology at once showed itself an inappropriate term for the new knowledge that then began to be created; nevertheless, it was long retained to express the study of the contents of the ancient literature, that is, the entire domain of ancient knowledge. It was therefore, in mediæval times, a compound study of the literature, grammar, style, history, customs, philosophy, political and natural science of the Greeks and Romans. Later on, this term was again narrowed to the grammatical and literary meaning it had once before possessed.

The comprehensive meaning of philology as a study of the classical literatures and all that they contain, in fact as a study of Greek and Roman antiquities in the widest sense, has now passed away, and philology has with us at once a narrower and a wider meaning. It is narrowed down to the study of, as one might say, the life history of language, and it is widened out to the study of not only Greek and Latin languages, but of all the tongues of the world. It has taken on definitely a comparative aspect in fact, and in this doing has become a true science capable of infinite extension; no longer limited to a critical aspect, but able to enlarge the bounds of knowledge.

The new phase of philology may be said practically to begin with the foundation of the Asiatic Society in Calcutta in 1784, and the systematic study of Sanskrit, under the energetic impulse of Sir William Jones. Men were amazed to find that in this most ancient speech there were large elements of kinship to Greek and Latin, and it was not long before it was authoritatively declared that Sanskrit, Old Persian, Greek and Latin, were members of one family. The old-fashioned philologists were agast at the heresy. All sorts of explanations were preferred, the most amusing perhaps being that of Dugald Stewart, who suggested that Sanskrit had never existed at all in actual fact, but was a manufactured literary language, a secret tongue for sacred purposes, made up by the Brahmans from their knowledge of Greek and Latin. But Frederick Schlegel, in his great work on the "Language and Learning of the Hindus" (1808), once for all grouped these languages, adding to them most of the European tongues, as the family of "Indo-Germanic Languages." We now prefer the term "Indo-European," or the Sanskrit and Persian word "Aryan," as indicating at once the kinship of race and the possible origin of the whole great stock from the central plateaus of Asia. The article ARYAN gives the main views of this relationship and a short list of the European and the Asiatic tongues comprised in the mighty family, as well as a few

examples of what are believed to be the Aryan roots traced through several of their derivatives. The article INDO-EUROPEAN FAMILY OF LANGUAGES gives a more detailed account. It is not at all thought that Latin comes from Sanskrit as French does from Latin, but rather that Sanskrit, Greek, and Latin on the one hand, and two or three of the main Teutonic branches on the other, all developed from a primal Aryan stock.

This theory has met with so many corroborative illustrations on all hands that it is now only with quite an effort that one realizes that there was a time, not a century ago, when the vague surmise that "Hebrew was the tongue spoken in Paradise," enunciated by the early fathers, was accepted as probable, and its corollary, that all tongues were modifications of Hebrew, was even more widely held. Starting from this *à priori* view all the learning of the moderns was brought to bear, from the Renaissance onwards, in support of this chimera. Even when Leibnitz, following our own Bacon, pointed out that the proper way to investigate a subject was to gather the facts first and formulate the theories afterwards, he found few who were willing to attend to him. These few, however, set to work to collect alphabets and grammars, to note down forms of speech of various nations, and thus to accumulate the materials for an extensive philological induction. From the year 1800, when Hervas, a Spanish Jesuit missionary, published six volumes of a catalogue of languages, till these present times, the diligence of explorers has been unceasing. It was soon found that the language of the greater portion of mankind differed not only in speech, but in the kind of speech from the well-inflected tongues of the Aryan and Hebrew families. The flood of light now shed over the Aryan family [see GRIMM'S LAW, ARYAN, and INDO-EUROPEAN FAMILY OF LANGUAGES] shines less upon the Hebrew or Semitic family [see SEMITIC LANGUAGES], and has as yet scarcely reached to the other two chief divisions, which still wait for a new method of grouping, to be discovered by a new Bopp and a new Grimm, since our own method, invented by those great men, is almost unserviceable to these more primitive forms of speech.

The main position arrived at with regard to human speech as a whole is its division into three large masses—I. monosyllabic; II. agglutinative; and III. inflected, differing radically in their structure.

I. It has been shown in the article ARYAN and elsewhere that at the basis of all speech lie roots, and specimens of such roots are given in the article referred to: but whereas these roots are scarcely ever used without modification in the Indo-European tongues, and are allowed to become each one the parent of a multitudinous progeny (*e.g.*, *tru*, *tru-e*, *tru-th*, *tru-th-ful*, *tru-th-ful-ly*, &c., *un-tru-th*, &c., *tru-ly*, &c.), the *monosyllabic* tongues use the bare roots alone. Chinese is the most accessible example of this structure. It is believed to have not much more than 500 words, each a monosyllable. These are multiplied at least threefold by varieties of intonation, and are then combined variously together, but without change. It is the childhood of speech which we may parallel in the babble of our children, destitute of inflexion and of minute shades of expression, but perfectly intelligible for all that. In Chinese the roots have become in many cases auxiliaries (see the article of that name), but have stopped short of becoming a definite part of speech. The words in Chinese are usable as noun, verb, adjective indiscriminately: just as our baby's "me!" signifies various meanings to a sympathetic mother, without possibility of confusion; now meaning "Here am I," now "Take me up," now "That is mine," &c. So in Chinese *ta* means "great" in any form whatever; whether greatness (noun), great (adjective), to grow great (verb), greatly (adverb), or any other meaning. To us this seems deplorably vague, but the Chinese themselves despise our inflected speech as

wanting in abstraction. They say, "Your Latin *magnus* qualifies one great masculine object which is in that state described by the positive degree and the nominative case, probably about to perform some act or to be the subject of some statement; and so, varying the description, is it with other varieties of the word. But where is the abstraction great, irrespective of singular or plural, nominative or accusative? You have it not; and that is our *ta*." To express the plural in Chinese the word "multitude" (or many) is employed as if one were to say "crowd man" for "men;" and perhaps that may serve as a sufficient example of the method of the language. With a few exceptions, as for instance, the fact of the possession of an article having two genders, and the important difference that the Egyptian roots are not always monosyllabic, the ancient Egyptian is a speech of this same type. That is not to say that Chinese and Hieroglyphic Egyptian have any kinship; but merely that they crystallized at nearly the same primitive stage, the Egyptian having just trembled on the verge of inflexion, one step further than the Chinese ever went. This type is often called Hamitic; and besides the Hieroglyphic Egyptian there are two northerly divisions—the Berber or Libyan and the Ethiopic, including the Somali, the Galla, &c. But there is also a large body of South African tongues, such as the Hottentot, the Bushman, &c., which Bleek and others would claim to be akin to the Egyptian type because of their Hamitic structure of bald and separate roots, but possessing the rudiments of gender. (It may here be noted that in one of the easternmost of the Central African tongues, itself of very simple structure—the Oigol—there is a remarkable type of gender: things are distinguished not as masculine and feminine, but as noble and ignoble by gender, and among the ignoble are all female things. May this be the savage origin of gender?) Returning to the consideration of ancient Egyptian, we have to regret our imperfect knowledge of it, because Egyptian literature is in large part lost, but fortunately the literature of its great co-type, the Chinese, is abundant and varied, extending for almost 4000 years backward into time. One would expect to find a language so bald, dealing in plain unaltered roots, to be unalterable; the tree alters from day to day, but the pebble does not change. Nevertheless old Chinese is very different from the current speech, and sinologists are at the present time hard at work upon these changes, in which they hope to find a clue to the development of monosyllabic speech in general. We may rank as of the monosyllabic, or, to be more accurate, as of the strictly uninflected type of languages, the Chinese (pure), Hieroglyphic Egyptian (nearly pure), Ethiopian (becoming inflexional), Tibetan (with a few inflexions), Siamese, Burmese, and Annamese (all abounding in auxiliaries and indicative particles, but without inflexion proper), and the Japanese—the last being of a somewhat hybrid type, tending towards the agglutinative, but with more monosyllabic than agglutinative elements. Excepting that Japanese contains many Chinese words, directly borrowed, all these tongues should be pronounced entirely distinct from each other. As far as our present knowledge extends, each of them is a distinct family in itself; but fuller acquaintance with them will no doubt yield further points of similarity or difference. It seems in the highest degree improbable to assume, as many philologists rashly do, that identity of type implies kinship. On the other hand it does imply equality of development. These monosyllabic tongues are relics of barbarism, one remove from mere savagery, and the fact of the splendid use that the Chinese make of so rude a material only shows the marvellous power of civilized man to adopt inefficient tools to his purposes, as when a Russian peasant carves out a roomful of furniture with his axe. In monosyllabic tongues we see the beginning of speech.

II. The next step is to the *agglutinative* type, by far

the most important example of which is the Turanian or Scythian family, a group of kindred tongues of large extent in Europe and Asia. Of the European branch the Finnish, and the closely allied Esthonian and Livonian, and the Lappish speech in Scandinavia, form one section; another is the Hungarian and its parent (though now widely separated) stock, the Ostiak and Wogul, spoken in and beyond the Ural, and akin to these are many other tribes in Eastern Russia: the Finns with the Kalevala of the sixteenth century, and the Hungarians with fragments of the twelfth century, and a complete literature from the sixteenth century onwards, though scanty at first, because of the favoured use of Latin as the literary tongue. In Northern Asia, and overlapping into Europe, the second or Samoyed branch, without culture or importance, save in extent, stretches from the North Sea to beyond the Yenisei and southwards as far as the Altai Mountains, presumably the cradle of the race. The third or mid-Asiatic branch is still larger; it is the Turkish or Tartar branch (more correctly Tatar), running into Europe in the south eastern corner, now for over four-and-a-quarter centuries enslaved by the Ottoman Turks, but chiefly known as covering Central Asia. The Ottomans or Osmanli Turks of European and Asiatic Turkey, the Turkomans and the Uzbegs of the Trans Caspian country, the Khirgiz of the Steppes, the Yakuts, who extend up the Lena to the sea, are the chief peoples. Of these the Uigur Tatars, who got an alphabet and some culture from Nestorian missionaries, have a scanty literature extending back as far as the eighth or tenth centuries; and the Jagatai Tatars of the south-east have abundant records of the fourteenth to sixteenth centuries; whilst Turkish literature is tolerably extensive from the middle of the fifteenth century onwards, with a large admixture of Persian and Arabic materials.

All these tongues are really related, beyond the fact of them all having a strongly marked common agglutinative type. It is time to explain what is meant by agglutinative, and this is perhaps best done by an example. Inflected tongues, such as our own, form plurals, for example, by inflexion, either by the addition of *s*, as *brothers*, or by a great internal change, as in *men*, and in the second case the root has become seriously altered. So also the past of the verb is usually made by *ed* or *d*, as *walked*, *loved*; but it is also made otherwise, as *went*, *spoke*. Now the Turanian type never adopts the latter of these methods: *lar* (or *ler*) in Turkish, for example, makes the plurals everywhere; and indeed in all cases the roots are never tampered with, but the auxiliary particles are merely glued on to them, as it were—whence the name agglutinative. Thus, taking a Turkish example, *ev* is a house, *ev-den*, from a house, *ev-üm-den*, from my house, *ev-ler-üm-den*, from my houses, and so on. So also with *sev*, love; we get *sev-mek*, to love, *sev-me-mek*, not to love, *sev-e-me-mek*, not to be able to love, *sev-dir-mek*, to cause to love, *sev-dir-ish-mek*, to cause one another to love, *sev-il-e-me-mek*, not to be able to be loved, and so on and on until we reach *sev-ish-dir-il-e-me-mek*, not to be capable of being made to love one another; and since each of these many forms has a full conjugation, the possible inflective forms from any one root rise to a number which is immense as compared with any Indo-European verb. But on the other hand the distinction between verb and noun is very much less sharply drawn than with us; thus to express "I strike" the Turkish gives *dogur-um* (stroke-present, I), and for "I have struck" *dogul-um* (stroke-past, I), while "he has struck" is simply "stroke-past" (*dogdi*); "strokes-past," the plural (*dogdi-ler*), giving "they have struck." The vowels have a peculiar harmonic relation in this family—they tend to become assimilated. The Turkish sign of the infinitive is *mak* or *mek*, and the plural ending is *lar* or *ler* according to the vowel; thus we have *al-mak* but *sen-mek*, *ev-ler* but *ayha-lar*, &c. In some dialects this assimilative pro-

cess is of a wonderful degree of intricacy. No doubt time will bring some Grimm with a comparative grammar of Turanian to develop and explain all these changes: at present all that can be said is that while of a type so markedly different to our own, they are equally firmly grouped and equally characteristic.

Other agglutinative languages are the Mongolian and Tungusic, though these differ so considerably as to be classed hesitatingly with the pronounced Turanian stock as to type, for of real kinship few if any traces are as yet known to us. The Manchus, a tribe of Tungusi, have conquered and administered China for the past two centuries; both they and the Mongols have alphabets akin to that of the Uigur Turks, but their literatures are quite modern, and mere imitations of the Chinese. Their agglutination is so feeble as sometimes to be wanting, and they tend towards the monosyllabic type of their neighbours and subjects the Chinese. We should class these therefore as of a less ancient type than the Chinese, while older than the developed Turanian. A group more nearly akin to the Finnish branch in structure, and therefore of a later date than Mongol, though curiously enough its literature is among the oldest of the world, is the Akkadian, the extremely ancient Chaldean language spoken by the inventors of the cuneiform alphabet, adopted by both Indo-European and Semitic peoples. If this classification is found to hold good, we seem to perceive that the Turanian people started the civilization of the world somewhere in Mesopotamia, whence the Aryan and Semitic peoples developed it along diverging lines. But this as yet wants further proof.

The native languages of Malay-Polynesia and of Australia are somewhat agglutinative in structure, but remain difficult to class as yet. In many elements they are of the monosyllabic, *i.e.* separative type, but the roots are most frequently of two syllables, and a very great use of reduplication prevails. The Dravidian tongues of Hindustan, the Tamil, &c., spoken by 30,000,000 or 40,000,000 people, are on the other hand of the very highest type of agglutination, and form perhaps the most finished development of that type known to us. There seems to be some slight indications of actual kinship with the Turanian family. A very remarkable alliterative type is presented by the languages of the ZULU tribes, which is dealt with in the article under that title.

The native languages of America form another great body of agglutinative speech, but of quite a different character. It is often called polysynthetic, from its tendency to incorporate all possible relations into one word; in fact, to crowd the whole sentence into the verb. All sorts of signs of time and place and modification are available; and credible witnesses assure us that as many as 17,000,000 of distinct verbal forms could be made from one root (Rev. T. Hurlbut on Algonkin dialects), which truly seems incredible. Of course the tendency is towards words of great length. Thus, "kneeling before him" had to be expressed in the well-known Massachusetts Bible by "coming to a state of rest upon the bended knees, doing reverence unto him," *wut-appestutquasun-noovecht-unuk-quoh*. It is manifest that such a structure is capable of indicating *nuances* of expression beyond anything that our Eastern speech can attempt; and were the Americans a rising instead of a rapidly perishing race, we might have a nobler language from them than any yet spoken. On the other hand, in its present form, it is certainly cumbersome and time-wasting. It is characteristic of it, and in the blankest opposition to Chinese peculiarities, that whilst it has many separate verbs for "washing," expressing all varieties of washing known to the people, each variety having its separate word, yet the simple idea of "to wash," as apart from any particular form of washing, cannot be expressed in the language. Another very curious peculiarity running

through all the American tongues is the *inanimate* gender, the distinction between organic and inorganic life by a grammatical gender, as we distinguish sexes by our masculine and feminine. And another remarkable trait is the double first person plural, one including and one excluding the person addressed. These and many other peculiarities range, speaking broadly, from the Eskimo to the Antarctic Ocean with few exceptions; and the whole native dialects of North and South America seem therefore to be related. But this relationship is one merely of type. No real descent or kinship has yet been discovered between any two. Attempts to connect them with any old-world family have also as yet been utterly unsuccessful. Within themselves the American-Indian tongues present great diversities, some of them having inflexions worn down to almost unrecognizable type, as with ourselves [see INFLEXION], others almost as fresh as if just developed.

III. It remains to mention the third type of languages; but this is so fully dealt with elsewhere that it may be shortly passed over here. This is the *inflected* type of languages, where by variations of the roots of the speech the various modifications of meaning are made, or the various relationships to the other words in the sentence are expressed. Evidently we have here an extension of the agglutinative form, and indeed we can trace, as in our auxiliary verbs and elsewhere [see the articles AUXILIARY VERBS and INFLEXION], the agglutinative stage of our own tongue. But it is curious to watch the simultaneous degradation or wearing-down which operates on the language, so that original agglutinations become worn down into inflexions, and inflexions in their turn become so worn that auxiliaries have to come in to replace them, by a secondary method of agglutination as it were. For example, the French *aiderai* shows the auxiliary *ai* (part of the verb *aider*) quite firmly agglutinated to the worn-down *aider*, once itself an inflexion. The *inflected* type of languages contains two great stocks, the *INDO-EUROPEAN* (or *ARYAN*), and the *SEMITIC*; the first the most prominent, and the second its close competitor, in the history of the world. None but the Semites have seriously disputed with our family the headship of the human race; and of the three great conquering religions of the world, the Buddhist is Aryan, and the Christian and Moslem are Semitic in origin. Of these the Christian religion has attained its pre-eminence not in Semitic, but in Aryan lands. In the article *SEMITIC LANGUAGES*, their curious triliteral roots, the timelessness of their verbs, the picturesqueness, the persistency or changelessness of these tongues, so markedly different from the restlessness of our own family, are treated of and exemplified. Much earnest effort has been devoted to show a common relationship between the Semitic and Indo-European families; but the dissimilarities far outweigh the similarities, and at present if a decision were to be forced, it would have to be against any race-connection. But it seems wiser to leave the question open for the time.

To the question whether the Indo-European tongues have passed through a Semitic stage no answer can yet be given. It is generally admitted that a monosyllabic or strictly uninflected stage is the beginning of every speech, and the Chinese and ancient Egyptians (speaking broadly) got no further; that an agglutinative stage comes next, and the Dravidian tongues of Hindustan, beautiful as they are, have remained at that pitch; and then the question comes whether our own instances of triliteralism (*sing, sung, sung* for example) point to a third or Semitic stage, or whether the Semitic tongues, as we know them, did not pick out one of our many inflexional varieties and crystallize that into a law, while we on our side continued to develop, not in that way alone, but in all other inflexional methods.

It is to these and kindred topics, to the solving of the

riddles presented by the anomalous tongue of the Basque peoples (Euskarians), of the ancient Etruscans, of the tribes of the Caucasus, &c., that attention is now drawn. Seeing what has been accomplished in not much more than three-quarters of a century of really active work at the new philology, who would be rash enough to predict that we are not treading on the verge of one of those gigantic inductions which are the glory of science? The aim of the philological induction is now no less than to explain the mysteries of the real origin and development of the various races of men who people this planet. Such a magnificent hypothesis, when duly formulated and demonstrated, would rank with Newton's "Theory of Gravitation" and Darwin's "Theory of the Development of Species," and like them would rule the world.

PHILOMELA, a daughter of Pandion, king of Attica, whose sister Prokne was married to the cruel Tereus, king of Thrace. He preferring his sister-in-law to his wife sent Prokne into the country, giving out that she was dead, and took Philomela to wife. But she discovered the secret, whereupon Tereus cut out her tongue that she should not tell it. Philomela outwitted him by weaving it into a peep which she sent to Prokne, and the pair of sisters then met together. Flight from their inhuman husband. Tereus, pursuing them with an axe, was on the point of striking them down, when, at their prayer, the princesses were metamorphosed, Philomela becoming a nightingale, Prokne a swallow, and Tereus a hawk which incessantly and generally in vain pursues them. They meanwhile take refuge near the friendly haunts of men. Other versions reverse the parts of Philomela and Prokne, and Tereus is sometimes described as becoming a hoopoe.

PHILOPOIMEN (Lat. *Philopomenus*), one of the few illustrious men of Greece after the time of Alexander. He was born B.C. 252, at Megalopolis in Arcadia. He grew up a complete type of the soldier at his best, refusing, for instance, to join in athletic training lest it should weaken him for the common everyday hardships of the soldier. In 222 he began to free his own country from Sparta, and in 221 helped the Macedonians to completely overthrow the Spartans at Sellasia. Philopomenus then went to Crete and served with great distinction. On returning to Greece he was elected general of the Achaian cavalry, and conducted some brilliant expeditions. It had always been the dream of his life to revive the unity and independence of Greece. This he sought to do by means of the Achaian League, of which he was now elected commander-in-chief or strategos (B.C. 208), an honour seven times afterwards repeated. The wonderful advances in drill and efficiency which the new commander introduced advanced the hitherto ineffective forces of the league to the very foremost rank. Even in his first year he was able to quell the Spartans at Mantinea, killing the Spartan king with his own hand. At the ensuing Nemeian games he was proclaimed by heralds the liberator of Greece; and his authority (though he still remained the same simple blunt soldier) was so absolute that the King of Macedon dreaded a complete overthrow of his supremacy on the part of the Greeks, and repeatedly sought his assassination. For some not very clear cause Philopomenus, after another great blow at Sparta, set out for Crete a second time. While he was there the great Roman invasion occurred under the consul Flaminius in B.C. 198, followed by the ruin of the Macedonian supremacy, and the famous proclamation by the consul at the Isthmian games, that Greece was free. Flaminius had hardly left Greece when Nabis of Sparta began to endeavour to bring the Achaian League into subjection. Philopomenus was recalled and made strategos, and had little trouble in restoring the supremacy of the league. He now devoted his energies to consolidating Greece; but in an evil moment Sparta revolted and murdered many of his comrades and friends.

with great barbarity. At last, in 188, he razed Sparta to the ground, annulled the national legislation of Lycurgus (Lakourgos), and substituted for it the Achaian code. Later on (B.C. 183) Philopoimén was taken prisoner by the Messenians, who had revolted, and whom he was about to coerce into submission to the league. After treating him with much indignity, they compelled him to drink poison. Next year they were severely punished, and their whole territory laid waste, while the ashes of the beloved chief were carried to a tomb in Megalopolis with the greatest honours, and the historian Polybius (Polubios) bare the urn. Philopoimén was hampered throughout by the real sovereignty of the Romans, but Greece was still nominally free, and it was his attempted task to foster the few elements of nationality left, and yet not to incur the vengeance of Rome. His death ruined all hopes. Further, the dire punishment of Sparta had alarmed the Romans and brought them again into Greece, under Metellus, B.C. 185; but in truth it would have been impossible to avoid offending Rome. It was but the fable of the wolf and the lamb, and Philopoimén must not be blamed for the inevitable fate of his country.

PHILOSOPHERS' STONE, a mythical substance, believed to be probably a red powder, sought for in vain (because it never existed save in imagination) by the alchemists. [See *ALCHEMY*.] It was held by the Arabians, and curiously enough it becomes increasingly the dream of these our later days, that all the metals are varieties of one substance or of some very few substances; consequently these early chemists came to believe that there must be some stone, crystal, or powder, which would dissolve and recombine the elements of any metal, changing it into some other metal, in the same way as by judicious arrangements we now convert electricity to light, to heat, to magnetism, &c. Naturally the particular stone sought for was that which would produce gold, and for many centuries many earnest seekers seriously spent their lives in the quest, while incomparably more made the idea a cover for quackery and imposture. From ancient emperors, as Caius (Caligula), mediæval popes, as John XXII., there were few but at some time or another dabbled in the fascinating search, and out of the study of the innumerable compounds and combinations thus made grew the science of chemistry.

PHILOSOPHY is a very chameleon of a science. The word simply means love of wisdom, or desire for knowledge (Gr. *philos*, dear; *sophia*, wisdom). But scarcely two philosophers in all the 2500 years that it has existed, from Thales of Miletos to the latest system-monger of to-day, would perfectly agree in the aims and limits of philosophy. And indeed in this very vagueness here is safety. For while science after science crystallizes itself into definiteness, and in so doing shrinks the borders of that philosophy which once included them all, there is always still left an undefined region of central hypotheses and inquiries touching each science, and therefore in a sort common to all, and connecting the whole circle of sciences with each other. This neutral central ground, called philosophy, remains to give scope and field for vast imaginings in the nature of pure thought, now in this direction and now in that, striving after aims never won, perhaps never to be won, but giving men blessings by the way in that very act of striving.

Most unfortunately Aristotle, in creating and defining the mental sciences of logic, ethics, and æsthetics, sought to create also a "first philosophy," or science of first principles, left unnamed by him, which as his treatise upon it came "after the *physics*" (*meta ta physika*), received the general popular name of *metaphysics*. By Aristotle's separation of metaphysics in the form of a *first* philosophy, instead of the true separation which should have been that of a *last* philosophy; by his endeavouring to lay down

fundamentals beforehand for all knowledge, instead of endeavouring to elucidate them by gigantic inductions from the general mass of knowledge, Aristotle gave life to that very *a priori* delusion of which he was himself so bitter an opponent. For centuries on centuries men wandered in the trackless thicket of metaphysics, scheming out possible plans in endless variety, and never getting a step further. For these dreary centuries the term philosophy was almost limited to metaphysics alone. Its chief divisions were *Ontology*, or the science of Being, and *Epistemology*, or the science of Knowledge. What is Being, or Absolute Existence? What is Knowledge? Whence is it derived? What things are knowable? Such were the questions attacked. Locke (born 1632) perceived that the human understanding must first be studied before that which it understood could be limited or even investigated with profit. Hume advanced further along the new road; and the great Kant (born 1724) in his "Critique of Pure Reason," still further; and after the work of the latter, the department of ontology was at an end for clear-minded philosophers, since it was shown to be beyond the limits of the human mind to apprehend absolute non-related existence, or "things in themselves." Upon the attitude of Kant, Professor Huxley ("Hume," London, 1879) has some excellent remarks. "Kant has said that the business of philosophy is to answer three questions: What can I know? What ought I to do? For what may I hope? But it is pretty plain that these three resolve themselves in the long run into the first. For rational expectation and moral action are alike based upon beliefs; and a belief is void of justification unless its subject-matter lies within the boundaries of possible knowledge, and unless its evidence satisfies the conditions which experience imposes as the guarantee of credibility." The natural sciences give the answer to—What do I know? A new science, that of psychology, had now to arise to give the answer to—How do I acquire knowledge? Philosophy remains to investigate the principles and limits of both, and search for—What can I know? Gradually the science of mind, psychology, grew up, attacking by the genuine scientific method of observations the facts of the mind, and patiently arriving at steady knowledge of its operations. But Kant, though he rendered psychology necessary, did not himself begin it; nay more, although he roundly asserted, and in fact proved to all who do not wilfully close their eyes to proof, that nothing can be known which is not directly related to the knowing mind, yet he asserted that the fact of existences outside the mind remained true; that although we could not know "things in themselves," yet such things did really exist. Thus was a loophole left for the mists still to enter and cloud the brains of men. When we can tabulate results and find their laws (the *how*), of what possible use is it to make unverifiable assertions about the unknown and unknowable causes (the *why*) of those results? We find by working with Locke and Kant that all knowledge contains an element of ourselves, that self-consciousness is inevitable and universal; which is to say in other words, that when we say we perceive a thing, we do not mean that we are conscious of the existence of matter *per se*, but only that we are conscious of *our perception* of matter. This is what makes the unreality of visions and delusions so extremely difficult to prove, for a visionary apple, due to some disease of the optic apparatus, is just as real to the patient as is the sight of a true apple to a healthy man. It is only when other senses are brought to bear, and their evidence is corroborated by other witnesses, that the true is distinguished from the seeming; and even then it is impossible to prove the actuality of the thing under consideration, for why may not all the senses and all the persons investigating it be under a delusion? We know, indeed, historically, that whole nations and generations of

men have gone hopelessly wrong on mere matters of fact, have seen things which never existed, or failed to see things which were staring them in the face. Such facts are the common experience of every science in its history onwards. And it is of course far worse in the case of inductions from facts. At the present day, to take one glaring example of this last, England is the only country which has adopted the plain commercial truths embodied in the term "Free Trade," truths which remain invisible to the eyes of other nations, self-evident as they are to ourselves.

If, then, we abandon the realm of ontology as belonging to the unknowable, and if to investigate the knowable be the task of psychology, the science investigating the organic mechanism of thought, and therefore the limits of it, what remains for philosophy? Metaphysics in both branches being cut away from it, has not philosophy been destroyed? On the contrary philosophy only now begins to be able to exist in a scientific sense. It is due to Comte and to Herbert Spencer in our own generation that reconstructing philosophy altogether on a scientific basis, we attack its problems first with the widest possible range of observations, upon which we proceed tentatively to erect theories inductively, which we then at once submit to the deductive test of experiment and verification. We have gained the power of advance.

The fundamental problem of the new philosophy, call it positive philosophy or any other, is to give a *reasoned explanation of the phenomena of the world we live in*; to give a science of the sciences; to elaborate the principles, possibly in after ages the one principle, of the universe; to answer the immense question *How?* The first thing to be done is to classify the sciences, work splendidly accomplished by Comte and by Spencer; the next is to use them one against the other to force out from them their ultimate laws, the principles governing their development and their character, and these are the gigantic inductions which hover around us in all physical and mental sciences at the present day. All these inductions are to be gathered together by the new philosophy, are to be systematized, co-ordinated, and connected. That will be the work of the future. The work of the present is rigidly to test these inductions—to reduce them to the lowest possible number—to bring heat under light and both under electricity, and all together under motion, if we may hazard a not improbable example—and to carry on this work not only in physical, but also in mental phenomena.

Thus we have already separate fragments of true philosophy. We have a philosophy of history, a philosophy of sociology, a philosophy of mind, a philosophy of astronomy, and of the other physical sciences, a philosophy of language, a philosophy of art, and so on. Many of these tend to run together, that is the interconnection of separate departments of knowledge begin to show the connecting philosophical link; and as time goes on these links will grow into one great chain of philosophical doctrine, themselves destined to be coupled by fewer and fewer links as still higher and more comprehensive principles are discovered.

History of Philosophy.—Speculations upon the riddle of the world were not likely to arise in the action-loving northern nations, nor in the imaginative but acquiescent Orientals: it was the peculiar combination in ancient Greece of highly cultured imagination, with high and almost restless activity, which afforded just the material for the new attempt. It was no matter that the attempt was made along wrong lines, the wonderful thing is that it was made at all. Once set pondering on the great philosophical problems, the Greeks so exhausted their own lines of action as to leave nothing for their imitators, the Romans, to do; and all philosophy remained Greek philosophy until the revival of letters, and the arousing of the

mind of Europe from the slumber succeeding the downfall of ancient civilization.

The polytheism of the classical mythology failed to explain the mystery of the world of phenomena, and therefore the Greeks abandoned the explanation of the universe representing it as depending on the arbitrary will of Zeus as to the rain, of D  m  ter as to the crops, of Apollo as to the sunshine, &c., and determined to seek out some more intelligible explanation, and thereby to lay bare the fundamental principles of things. The earliest school of Greek philosophy is therefore a purely cosmical school, intentionally a complete divorce from theology altogether.

Pythagoras.—The curious, ill-understood, very mystical number-philosophy of Pythagoras is an attempt by itself outside the main current; and owing to the absence of authentic documents we can hardly explain either its origin or its results. Epicharmos, Philolaos, &c., were of this school.

Ionian School.—Thal  s of M  l  tos (born B.C. 636) saw the universal prevalence of water everywhere—dryness meaning death, moisture meaning life—and had hazarded the suggestion that perhaps the whole kosmos began in water. Little is known of the real views of Thal  s. Anaxim  n  s of M  l  tos and Diogenes of Apoll  nia early in the sixth century followed out Thal  s' search for an *arch  * or beginning of things, placing it, however, not in water, but in air. But this merely material view was so unsatisfactory that a new start was made by Anaximandros, who refused to accept water or air or any one thing as the principle of the universe; this he asserted to be the Unlimited All. The various phenomena of nature each of them shared in this All.

Eleatic School.—Meanwhile a similar doctrine had been worked out by Xenophan  s of Kolophon (probably 540–500 B.C.), quite as much on what we should consider a religious as a philosophical line. Travelling from place to place teaching his new philosophical monotheism, Xenophan  s fixed at last on Elea, and hence comes the name of his great school. The search of Xenophan  s after the one infinite mind which originates and rules all nature was followed up by Parmenid  s and Z  n  , his successors.

Continuing the account of the Ionians we come to H  rakleitos of Ephesos (500 B.C.), connected with them by his advocacy of *fire* as the ruling principle of nature, but striking out a new path in identifying this with the divine Spirit, and in his famous doctrine of the universal flux of things. He was followed by Empedokl  s of Agrigento, and Anaxagoras of Klazomenai, who combated the Eleatic doctrine of unity as regards matter, contending, however, for a single spiritual force governing the various forms of matter (which Empedokl  s asserted to be earth, air, fire, and water), and by the Atomic school of Leukippos and Demokritos of Ab  dera (460–361 B.C.), who sought to resolve the universe into a product of matter and motion. But the Atomists, without perhaps perceiving it, had by their theory of atoms begun a new era. Hitherto, while many had investigated our conceptions of nature, no one had investigated the manner in which those conceptions came to us. Demokritos has the glory of first starting a theory of knowledge of the external world. His hypothesis was, that all things in nature were perpetually throwing off images of themselves, which entering the eye were received as representing the originals; and further, Demokritos admitted that these images were only external, and might not reach the eye exactly as they left the object—that is, he saw that there was no proof of the truth of our perception of matter, though he did not see this great discovery sufficiently clearly to formulate it.

The Sophists.—The feeling of the infinite possibility of error, foreshadowed in the earnest words of many of the later philosophers mentioned, led naturally to the invention of dialectics, an attempt at a criticism of opinion by de-

bate from various sides, so as to eliminate truth from error. An entire school, styled Sophists ("wise"), the greatest being Gorgias and Protagoras, arose in the fifth century B.C.; men who undertook themselves to debate, and to teach others how to debate, any possible opinion, and who earned a handsome income by their skill. Against these rose up the wonderful form of Sokrates (469-399 B.C.), who strove for the truth against the Sophists by means of their own weapons. They professed to teach everything; he confessed he knew nothing—his function was to examine opinion, to observe. But it is evident that by the manner of observation one can almost indicate the conclusions to which the observations are tending in the observer's mind, and though Sokrates never taught definite opinions, it is not difficult to see what his opinions broadly were. One thing he certainly did, he, first of all men, showed the proper way of investigation, by laying down definitions and then working out inductions.

The Cyrenaics and the Cynics.—Among the disciples of Sokrates was Aristippos (485-365 B.C.) of Kurion (Lat. *Cyrene*), a brilliant man of pleasure, holding that place among philosophers which Alkibiades (another disciple of Sokrates) did among statesmen. It is wonderful that the master should at the same time attract spirits like these, as well as their antagonists the Cynics, and yet inspire also the lofty Plato. But while Sokrates discoursed on "The Good," and sought to find its nature, Aristippos believed he had found it, and he set it in pleasure. Pleasure he asserted to be the only positive good and the test of good, and therefore the end and aim of life. His daughter and his grandson were among his chief followers, as also Euklemeros (whose theories of the meaning of mythology were of immense importance and still influence the world), and Hegesias, who taught that life was worthless, and that the "pleasure" which formed the great principle of the school was really to be found in the avoidance of pain. Hegesias may rank as a pessimist, a Schopenhauer born out of due time.

In close opposition to these men of pleasure (refined pleasure of course is meant), were the men of asceticism, the Cynics. The founder of them, Antisthenes (439-371 B.C.), was once a pupil of Gorgias the Sophist, and became a Sophist himself; but he was so captivated by the teaching of Sokrates that he not only reckoned himself a disciple, but brought all his pupils to learn also. He and his more famous pupil Diogenes (412-323 B.C.) rose in stern protest against luxury: "I had rather go mad than seek for enjoyment," said Antisthenes. The body, he taught, was vile and degrading, civilization a mockery, science delusion; the aim was to do with as few concessions to the needs of food and clothes as possible, to despise all discovery and learning in order to leave the mind free for higher things.

Platonism: The Academy.—With Plato philosophy was restored to its widest aim; Sokrates had his full influence, but his negative dialectics were followed up by Platonic affirmations. Plato (429-347 B.C.) began to teach about 386 B.C. in a sacred grove known as that of Hekademos or Akademos; and here a powerful school was founded. Not that Plato ever formulated a complete system; indeed almost every one of his own opinions is elsewhere in his own writings pierced through with criticism, not even the great doctrine of Ideas being an exception. Perhaps the central point of Plato's teaching is the detection of the One amidst the Many, in fact an almost religious or monotheistic view of phenomena both physical and mental. He stood for the supremacy of ontology as the highest knowledge. His most famous doctrine is that of Ideas, that all things and all faculties exist in perfection as absolute ideas; that there is an ideal beauty, an ideal virtue, &c., and these are the only real existences; and that this world of phenomena amidst which we live on,

possesses a dim shadow or a small part of those realities which the soul has once known in themselves and will hereafter know again. Things are beautiful, for instance, in proportion to the amount of the ideal beauty they contain, and the soul knows them for beautiful because it has seen in its previous state of existence the real idea of beauty. As Wordsworth says, so Plato affirmed,

"Our birth is but a sleep and a forgetting,"

and all that we have of best is the dim recollection of the soul. Plato's great aim was to show men how they might live up to this best, i.e. live like the gods.

Aristotle (384-322 B.C.) was born just as Plato began to teach, and as he grew up he became, during seventeen years, the foremost pupil of Plato. But whereas Plato had rested his philosophy purely on intuitions, Aristotle, when starting his own career, boldly stood for the perceptions of the senses as the true test of knowledge. Plato had said that the senses cheated; Aristotle rightly replied that we drew wrong inferences, but the senses were true. Further, Aristotle is the first of the ancients to resort to experiment as the test of hypothesis, as he was the first to base hypothesis on observation of actual fact. It was this great man also who founded the science of logic, so that the laws of thought might be investigated and errors and fallacies of reasoning avoided for the future. But by his method of research through observation and experiment, Aristotle had once again freed philosophy from the dogmatic attitude which Platonism would have developed into. Consequently a new school arose.

The Sceptics.—The school of indefatigable doubters, led by Pyrrho (Purphōn), high priest of Elis, rested their scepticism on the fact that there was no criterion of truth. How can one believe what it is impossible to prove true or false? Plato propounded his ideal theory; Aristotle showed it to be a creation of man's own brain. Aristotle in turn founded the theory of demonstration; but how can one observe without knowing whether the observations taken are true, whether they are not all vitiated by some blunder or unconquerable error. Is anything true, if so, what? And how do we know it is true? "We assert nothing," they said, "not even that we assert nothing." This is where the Sceptics stopped. We in our day admit all they challenged, but we go further and say, "What does it matter whether these things are true or not, so that they are true for us? If our theory holds good in each instance, that will serve; even if in higher eyes it should be faulty, we can accept it and deal with it as truth."

The Epicureans.—Contemporary with the Sceptics, and scarcely later than Aristotle, comes Epicurus (341-270 B.C.). Epicurus was twenty when Aristotle died. He struck out a new path altogether. Philosophy, said he, was the power by which reason led men to happiness. He despised metaphysical investigations, and sought out the means of happiness. This he found in pleasure, and philosophy he made to consist in the discovery how rightly to use pleasure. Mere immediate enjoyment, of course, is a shortsighted way of attempting happiness; what the aim of philosophy should be to secure is an equable and permanent enjoyment—happiness, not now for the moment, in a delirious torrent, but always, in a pure and life-giving stream. Epicurus therefore forbade luxuries; and cultivated temperance and every form of learning, so as to train the body to live wisely, and the mind to judge accurately. As for other opinions, Epicurus was an avowed Atomist. It is lamentable that all the voluminous writings of this much maligned man are lost.

The Stoics.—Much more numerous than the pleasure-philosophers of the garden of Epicurus were the followers of Zeno, who gained the name of Stoics from their master teaching in a *stoa* or colonnade. The Stoics rather followed Aristotle than Plato in their philosophy, and were firm opponents of the Sceptics, whose incessant doubt

they sought to refute by the arguments of common sense. Their conception of the governance of the world was stern and simple: it was matter controlled by reason. Man's duty was therefore to live in harmony with his reason. Efficiency is hateful, pleasure deceptive, pain contemptible. Logic is to be the rigid rule of life. This stern creed seized hold on the Romans, born soldiers, despisers of hardships and death; and all the best Romans who thought at all on the subject were rigorous Stoics. The danger of Stoicism is an inevitable egotism. We admire the lofty heroism of these classic Puritans, but we cannot love them. They dwell loftily apart from us. As far as a contrast between the ends of Stoicism and Epicureanism goes, it is rather a contrast of attitudes than of ideas; for the one must surely find happiness in its rigorous pursuit of duty, while the other would inevitably have to recognize the claims of duty in its search after true happiness. But Epicureanism can show nothing so grand as the saintly Emperor Marcus Aurelius, or the lofty slave-philosopher Epictetus, the glories of the later Stoicism.

The New Academy were opponents of the Stoics; but their teaching, though they showed a direct personal descent from Plato, deviated from Platonism towards Scepticism. They admitted the uncertainty of opinion because Plato had shown it; but they yielded to Aristotle's disproof of the Platonic ideas. This drove them to Scepticism and the debatability of all things. Though following the Platonic method, they really gave up the Platonic affirmations, and taught universal hopeless doubt. Greek philosophy was dead.

Neo-Platonism.—In this emergency the recoil of reverent men from such a negation of existence as that professed by the New Academy raised up a fine school of religious thinkers in Alexandria at the beginning of our era, the chief of whom were the Jew Philo, and the Greeks Plotinus, Porphyrius (Porphyry), and Proklos, whose lofty and truly noble conceptions even dared to rival Christianity. At one moment indeed, in the long rivalry of centuries, Julian the Apostate became emperor as the successor of Constantine, and Neo-platonism sat upon the throne of the world, replacing Christianity; but at Julian's death his successor restored Christianity as the imperial faith. In the speculations of Neo-platonism we see the highest point capable of being reached in the pagan religion. Philo accepted the scepticism of the New Academy, but overthrew it by a return to the Platonic teaching of intuition, especially applying it to discussing the nature of God. The famous doctrines of the *logos* and the conception of the Alexandrian trinity of the godhead, are due to Philo. The supremacy of the greatest ideas, and their superiority to all experience, so that they can be only apprehended by faith, formed a cardinal point with all these Neo-platonic thinkers. Plotinus taught that by long prayers and fasting it was even possible to become momentarily absorbed in the deity—a state known as that of "ecstasy"—which teaching guides us to mysticism and pantheism, and makes reason merely the justification of faith. Their views as to how the world came into being were comprised in the doctrine of emanation, which may shortly be described as substituting for the Christian position that God had created the world out of nothing, the view that the universe was a series of manifestations of his will or his intelligence; that the world was God, but God was more than the world. With Proklos in the fifth century of our era, this great pagan combination of religion and philosophy died out; and since then there has scarcely been another attempt to unite the two until the positivist effort of our own time.

Even before Justinian closed the schools of Athens and appropriated the educational grants, pagan philosophy had already withered. To the Christians of the dark ages moreover, any effort of the reason was abhorred; the blind-faith was the highest virtue. But since the first need

of a philosophy is that it shall be a reasoned system, it is evident that any period like that of the dark ages must be a period of inaction in a philosophical sense. Ancient philosophy had existed a little over 1000 years, and about another 1000 years lay between the closing of the Greek schools, in the sixth century, and the renewed separation of philosophy from religion by Bacon and Descartes in the sixteenth. This time was one long series of efforts of thinkers to assert themselves against the might of the Church.

The Arabians.—The feeble light of thought, which Justinian had hoped to extinguish, was driven by that very effort towards fresh fuel. The Greeks and Jews found an asylum with the Persians, and under the shelter of the Mohammedan princes of the East and also of Spain grew up a long succession of philosophers to whom men have given the name of Arabians—curiously enough, since not one of any eminence was of Saracen birth. These men preserved Aristotle more especially, but also Plato and others, by means of Syriac and Arabian versions; and it was in this way by bad Latin translations from the Arabic, and not directly from the Greek, that the men of the middle ages gained their knowledge of the Aristotelian philosophy. Al Kendi, Al Farabi, Averroes, and Avicenna in the East are the great names of the ninth and tenth centuries; Alhazen, Avenpace, Abubacer, Algazzali, and Avicbron in Spain are the rulers of thought from the eleventh to the thirteenth century.

The Schoolmen.—Scholasticism began in the schools opened by Charles the Great. In the dearth of manuscripts personal teaching was the only means of imparting knowledge, such as it was. Paris was the centre of the movement, which took the form of endless disputation, often about the most trivial matters. Eventually from out such futile questions as "how many angels could dance on the point of a needle," &c., there arose the great dispute as to Nominalism and Realism; the nominalists considering universals, or what we call general terms, to be abstractions of the mind, the realists following Plato in regarding them as having a real existence. The great realists are Anselm of Canterbury, William of Champeaux, Albertus Magnus, Aquinas, Duns Scotus; the great nominalists Roscellin, Abelard, and William of Ockham. So philosophical a question would appear to have little to connect it with religion, but nominalist teachers managed to couple speculations on the Trinity with it, and so incurred the ill will of the church. On the other hand the realists were easily drawn towards Pantheism, and so ran foul of church teaching. The last of the great schoolmen, our own countryman, William of Ockham, early in the fourteenth century, not only destroyed realism, but also brought to a head the feud between the schoolmen and the church by his diatribes against the temporal power of the Pope.

Modern Philosophy.—Now came the revival of learning, the correction of the second-hand "Arabian" versions of Greek philosophy by the diffusion of Greek itself, due to the taking of Constantinople by the Turks and the fall of the Greek Empire. The wondrous epoch of the Renaissance breathed activity into all men's minds. Natural science arose. Giordano Bruno, in Italy, perished at the stake in 1600 for attacking the scientific authority of Aristotle, now so thoroughly commented into a sound theologian, that more than once there was grave question of canonizing him. From Bruno's ashes rose, phoenix-like, our great English natural philosopher, Francis Bacon; and from him as the apostle of inductive method descend in direct line Hobbes, Locke, Diderot and the Encyclopædists, Hume and the Scottish School, Mill, Comte, and Herbert Spencer, in fact all that is worth having in English philosophy. At the same time arose the great founder of the modern deductive method, the reviver of metaphysics, Descartes; and from him descend in direct line

Spinoza, Malebranche, Leibnitz, Fichte, Schelling, Hegel, Schleiermacher, Schopenhauer (with Von Hartmann and the other pessimists), and Lotze; in fact the chiefs of the German philosophy. But both Bacon and Descartes united in demanding the freedom of philosophy from religious trammels, and Descartes even pronounced it, in his view, desirable to treat the two questions of the existence of God and the immortality of the soul from the philosophical side, at all events with a view to converting infidels.

Bacon (1561-1626) made experience the foundation of philosophy, and worked *a posteriori*; Descartes (1596-1650) made consciousness the basis of all truth, and worked therefore *a priori*. His philosophy may be compressed into an axiom: "all clear ideas are true." Hence his famous proof of the existence of men, "I think, therefore I am" (*Cogito ergo sum*), and his demonstration of the existence of God, since the idea of a God is one higher than ourselves, and hence impossible to emanate from our own mind. Spinoza (1632-1677) sought to unite the two entities, God and nature, into one ("there is only one substance and that is God"), creating a peculiarly noble form of pantheism.

Innate Ideas.—There directly arose from the Cartesian philosophy the doctrine of innate ideas, or necessary truths, independent of all experience; and from the Baconian side a very decided rejection of this teaching. This controversy has indeed proved to be the main one upon which the battles of the two great opposing armies of modern philosophy have been fought. The magnificent treatise of Locke (1632-1704) on the "Human Understanding" was the first powerful shot fired from the Baconian side, and the equally noble "Theodicee" of Leibnitz (1646-1716) answered it from the Cartesian side. Leibnitz constructed a beautifully logical scheme of the universe entirely on *a priori* grounds. He brought philosophy for the moment to the religious standpoint, on this ground: "God being all-good and all-powerful must necessarily choose whatever is best; the world therefore must be taken as the best possible world; whatever is, is best." Voltaire's romance of "Candide" laughed into nothingness this thoroughgoing optimism. Another famous doctrine of Leibnitz was a modification of the ancient atomic doctrine in the form of "monads," for an account of which the reader must be referred to the article LEIBNITZ, as also for an account of his doctrine of pre-established harmony.

Scepticism.—In revolt against these dogmatic doctrines, so at variance with the outside world, however logically complete in the study, rose Voltaire, Rousseau, and Condillac; and also Diderot, D'Alembert, Holbach, and all the group of great men classed as Encyclopædists, from the fact that many of them either wrote for Diderot's Encyclopædia, or were in harmony with its views. Like all insurgents these men were carried too far, and gloried in extreme statements. They are often styled atheists, and have other hard names flung at them; but this is only on the part of those who have not read them or who have read them with prejudiced eyes. Greater as a philosopher—indeed, supreme on the sceptical side—towers the gigantic intellect of Hume (1711-76), whose wonderful treatise on the "Human Understanding" spurred on Immanuel Kant to undertake his reconstruction of modern philosophy.

German Philosophy.—Kant (1724-1804) may be considered as the greatest philosopher who ever existed. It is his statement of the problems of philosophy which still rules the world; which is of course by no means the same thing as saying that his conclusions are everywhere adopted. Kant said that the *critical* attitude was the only one possible, and his great work is therefore a "Criticism of the Pure Reason." His object was to examine the extent to which the human mind could reach. As a result he differed from all three schools—from the dogmatists

(Descartes, &c.), because he demonstrated once for all that we can never know "things in themselves," but only their appearances, and showed ontology to be inherently sterile; from the sceptics (Hume, &c.) because he proved the existence of fixed laws for the human mind and the power of reasoning truly, in consequence; and from the empiricists (Locke, &c.) by asserting the existence of "things in themselves," a whole realm of experience open to the moral consciousness while unattainable by the intellectual faculty.

From Kant as a starting point the philosophy of our times radiates. Fichte (1762-1814), originally a Spinozist, became a Kantist, and emphasizing the latter phase of Kant's teachings spoken of above, produced a system of subjective idealism postulating both matter and form as a result of the activity of the Ego, the Ego positing both itself and the Non-ego. Schelling (1775-1854) on the other hand took his departure from Fichte and landed himself in an objective idealism—identifying subject and object like Fichte, but from a different starting point, that of the object; he is better known to us perhaps through his disciple Coleridge than from the original works. Hegel (1770-1831), whom most Englishmen find perfectly unreadable, began by holding much of Schelling's philosophy, but finally produced his own "absolute idealism." With Hegel philosophy is the science of the absolute. The *synthesis* of the world he derives from the union of two opposites, *thesis* and *antithesis*, which in themselves are at one. Being and Non-being are such a pair, each one positing the other as its opposite, and the combination of the two producing the phenomena of the world. But the synthesis thus gained may be regarded now as a thesis, and therefore at once posits its antithesis, whence comes a new synthesis. Thus all things are in perpetual flux (as in the old doctrine of Heraclitus); nothing is so much existent as becoming. Schleiermacher (1768-1834), the last of these great four, was the one who most closely followed the great teacher of them all, Kant. In philosophical position as distinguished from ethical theory Schopenhauer (1788-1860) was also chiefly Kantian, differing from Kant in his assertion of the possibility of knowing "things in themselves" through the will, a term which with Schopenhauer includes not only conscious but unconscious volition and desire. Von Hartmann in his "Philosophy of the Unconscious" has emphasized the latter phase of Schopenhauer. The pessimistic views of these two philosophers are dealt with in the articles PESSIMISM and SCHOPENHAUER. Here there is only space to say that in opposition to the too broad assertion of optimism by Leibnitz, that "this is the best of all possible worlds," they assert that it is "the worst possible world."

English Philosophy.—The practical character of English thought started by Bacon and continued by Locke was well borne out by Bishop Berkeley (1684-1753), whose theory of idealism—that is, the denial of the existence of matter in the sense of an occult substratum, and the assertion that matter is no more than the sum of its qualities—improves by time, and now altogether conquers the ridicule once assailing it when "excoffins vanquished Berkeley with a grin." The marvellous acuteness and subtlety of Hume (1711-76) was bent on showing that while Berkeley had proved matter to be an abstraction, mind was equally so. Matter, says Berkeley, is but a collection of impressions; Mind, says Hume, is but a collection of sensations and ideas. Hence arose scepticism. These speculations roused Dr. Thomas Reid (1710-96), who attacked them vigorously with his philosophy of "Common Sense," a hopeless effort against two such giants, but rendered respectable by the developments of Dugald Stewart (1753-1828), Dr. Thomas Brown (1778-1820), and more especially Sir William Hamilton (1788-1856), who most unhappily devoted a great part of his life to this

thankless task. One good thing that Sir William Hamilton did was to energetically deny all the pretensions of ontology; but a pupil of his, James Ferrier (1808-64), in a brilliant book, the "Institutes of Metaphysic," sought, against his great master's fiat, to revive it. The book remains deeply interesting and suggestive, but without any influence on modern thought.

The attitude of Sir William Hamilton brought forward the great genius of John Stuart Mill (1806-73), whose father, James Mill (1773-1836), had revived and greatly extended the associational views of mind in an excellent "Analysis of the Human Mind." John Stuart Mill advanced to the attack with an "Examination of Sir William Hamilton's Philosophy," his own view being that matter is a permanent possibility of sensation, and mind a series of feelings with a background of possibilities of feeling. His "System of Logic," a truly grand work, incidentally served to instruct a generation of Englishmen in philosophy. The culmination of this school, resting the whole structure of mind upon the powers of discrimination and of perception of agreement, and the tendency to associate and group together feelings and ideas, is attained by Alexander Bain, whose familiar works, "The Senses and the Intellect" and "The Emotions and the Will," are as admired as they are widely known.

Positive Philosophy.—Meanwhile the vast extension of natural science has raised up in France and in England an entirely new philosophy based upon natural science. Both in the "positive philosophy" of Comte (1798-1857), and in the "synthetic philosophy" of Herbert Spencer (born 1820) the aim is the amalgamation of science, philosophy, and religion into a coherent body of doctrine applying to thought and life in their entirety. The method is the transformation of science into philosophy, so as to bring all the sciences, physical, social, and moral, under a uniform logic. The ground-plan is the treatment of the sciences in a given order, and with a given scheme of concatenation. Spencer's arrangement of the sciences is also quite distinct from Comte's; and in fact more than once he has felt it necessary to clearly point out that while the general aim is the same in both, the actual systems have but very few points in common. Also, while Comte allowed himself to crystallize, Spencer has always kept himself unlimited. Comte made the great mistake of advancing from the critical and scientific attitude into the dogmatic, and constructing a sort of parody of the Roman Catholic religion, with saints' days and festivals, priests and temples, and even a new Supreme Being altogether, *Humanity as a whole*. It is needless to say that from this error the greater Englishman has always held himself free, while his advocacy of the evolution hypothesis, corroborated as it is in the department of zoology by the discoveries of Darwin, but entirely his own in social and moral fields, constitutes a very notable difference from Comte.

Comte failed by trying to make what can only grow, and that slowly, but he indicated a great and a very noble and cheering truth—that the newer we penetrate to the unity of nature the more shall we discern it to be only another phase or manifestation of the unity of God. As the master poet of our century (Goethe) has often said, "Nature is the robe of God." Towards this magnificent goal does the new philosophy bend its steps.

As to the Comtist worship of "Humanity" it is well to hear Mr. Spencer, and his wise words may fitly close this article, as representing the latest dictum of philosophy on the deepest and weightiest of all known questions.

"The object of religious sentiment will ever continue to be the unknown source of things; while the *forms* under which men are conscious of the unknown source of things may fade away, the *substance* of the consciousness is permanent. From causal agents conceived as imperfectly

known we progress to a universal causal agent which cannot be known at all. Having in the course of evolution come to have for its object of contemplation the infinite unknowable, the religious sentiment can never again (unless by retrogression) take a finite knowable like Humanity for its object of contemplation."

PHILTRE or **PHILTER** (Gr. *philttron*) was a potion given among the Greeks and Romans to excite love. It is doubtful of what these potions were composed, but their operation was dangerous, and often deprived persons of their reason. (Ovid, "Ars Amat." ii. 106.) Lucretius is said to have died from drinking a potion of this kind, and the madness of Caligula is attributed by some to a similar potion which was given him by his wife Caesonia. Their manufacture was extensively carried on by the poisoners and chemists of the middle ages, especially in France and Italy. No doubt the efficacy of most philtres, where they did appear to accomplish their ends, lay more in attention to the numerous additional practices recommended by the wise than in the medicines themselves. A jealous wife, believing that her husband would once more esteem her as the dearest of women by means of the philtre she had given him, readily became cheerful and attentive, avoiding all possible contention, careful to please by her dress and her manners, &c., as was enjoined for the assistance of the medicine; not thinking that the same simple arts would suffice just as well without the operation of any drug.

PHILYDRA'CEÆ is a small order of plants belonging to the group **MONOCOTYLEDONS**. It contains only three genera with four species, confined to the Malay Archipelago, the Australian region, and China. They are herbs with fibrous roots, erect leafy stems, and the leaves sword-shaped and sheathing at the base. The flowers are solitary, sessile, subtended by spatheaceous bracts; the perianth is coloured and persistent; it has four segments, two of which are small, and are considered by some to represent rudimentary stamens; there is a single stamen with a two-celled anther adherent to the anterior lobe of the perianth; the ovary is superior, three-celled, with axile placentas, and numerous ovules.

PHI'NEUS, in the Greek mythology, was uncle of Andromeda, whom he sought to marry. He was slain by PERSEUS. Another Phineus, son of Agenor of Thrace, figures in the Argonautic legends. He was twice married, and his second wife falsely accused her stepsons of improper conduct towards her; whereupon Phineus, without hearing them, put out their eyes as unworthy longer to behold the sun, and exposed them to be devoured by wild beasts. For this Zeus struck him blind, and sent wild bird-beasts called HARPAGES to snatch away or defile his food as often as he strove to eat. In return for his valuable instructions as to their journey the Argonauts freed him from this terrible scourge. The sight of the sons of Phineus was restored by Asklēpios; but the king himself remained blind as a punishment for his crime.

PHIN'TEAS (sometimes erroneously called *Pythias*). See DAMON.

PHLEBITIS (Gr. *phleps*, a vein), the inflammation of a vein. See VEINS, DISEASES OF.

PHLEGMA'SIA DOLENS. See WHITE LEG.

PHLE'UM. See TIMOTHY GRASS.

PHLOR'IZIN, a substance found in the root-bark of the apple, pear, plum, and cherry tree. It crystallizes in silky needles, containing two atoms of water, and having the formula $C_{21}H_{24}O_{10} \cdot 2H_2O$. It is soluble in boiling water and in alcohol, but insoluble in ether. Dilute sulphuric acid converts it into glucose and phloretin ($C_{15}H_{14}O_5$). Phloretin crystallizes in white scales; it is insoluble in water and ether, but soluble in alcohol. By the action of caustic potash it is converted into phloretic acid ($C_{15}H_{10}O_5$) and phloroglucin ($C_6H_6O_3$). Phloretic acid crystallizes in

prisms, and is soluble in water, alcohol, and ether. It combines with bases forming crystalline salts, having the general formula $C_9H_7M_2O_3$, and called phloretates. Phloroglucin may also be obtained from quercetin; it crystallizes in prisms, containing two atoms of water, and having the formula $C_6H_6O_3 \cdot 2H_2O$. The crystals are very sweet to the taste, and are soluble in water, alcohol, and ether; it melts at 220° C. (428° Fahr.), and sublimes unchanged. It forms a violet red colour with ferric chloride.

PHLOX is a genus of North American plants belonging to the order **POLEMONIACEÆ**, cultivated in gardens for the beauty of its flowers. The flower has a five-cleft tubular calyx, and a salver-shaped corolla with an elongated tube and a flat five-lobed limb; the five stamens are inserted on the tube of the corolla, and are of different heights; the fruit is a three-valved capsule, each cell containing a single seed. Most of the species are perennials, having unbranched stems 1 to 4 feet high, with opposite entire leaves and showy flowers in terminal clusters. A number of varieties have been established under cultivation. *Phlox Dracunculoides*, an annual, is a great favourite. The wild plant is found in great abundance on the prairies. The flowers, before cultivation, are deep rose with a yellow throat, but have given rise to a great many varied hues.

PHOCÆA and **PHOCION**. See **PHOKAIA** and **PHOKION**.

PHOCENIN or **DEL'PHIN**, a neutral fat found in the oil of the dolphin or porpoise (*Delphinus phocaen*). It is a mobile oil, of specific gravity 0.951; the boiling-point is 258° C. (496° Fahr.). It has the peculiar ethereal odour of valeric or phœnic acid, which porpoise-oil usually contains, in combination with glycerin.

PHCÆUS, PHCBE. See **PHOTIOS**.

PHENICIA and **PHENICIANS** (Gr. *Phoinikê*, *Phoinikês*). Phœnicie Proper (incorrectly called Phœnicia) was a very small country. It extended along the eastern coast of the Mediterranean, from the town of Aradus and the river Eleutheros, on the north, to Mount Carmel or Dora, on the south. It was bounded on the east by the mountains of Libanus and Anti-Libanus, from which numerous streams descended which rendered the land exceedingly fertile. This short line of coast was covered with numerous towns, celebrated for their arts and manufactures. The most southerly town of importance was Acco, called by the Greeks Acca, and subsequently Ptolemais (St. Jean d'Acce). In the time of Augustus it was a large city, and under Claudius it became a Roman colony. See **ACCÆ**.

North of Acco was **TYRE**, the principal of the Phœnician cities, and north of Tyre was **SIDON**. Between Tyre and Sidon lay Sarepta (Sarphad), which is mentioned in the history of Elijah (1 Kings xvii. 9) under the name of Zarephath. About $8\frac{1}{2}$ miles north of Sidon stood Berytus (Beirut or Bairuth), a very ancient town with a harbour. It also became a Roman colony, under the name of Felix Julia. Twenty-four miles north of Berytus was Byblos, near the sea; and north of Byblos, Tripolis, which originally consisted of three distinct cities; and still further north, Aradus, on an island, the chief town of Phœnicia next to Tyre and Sidon. It is the Arvad of the Old Testament.

The Phœnicians were a branch of the Semitic or Aramæan nation, and are said to have dwelt originally on the shores of the Red Sea or of the Persian Gulf, or more probably by the Dead Sea. But they must have been settled on the coast of the Mediterranean at a very early period, for Sidon was a great city in the time of Joshua (Josh. xix. 28). The Phœnicians excelled all the nations of antiquity as a maritime people. Libanus supplied them with building material for their ships, and they had iron and copper at Sarepta. They communicated with India by the caravans of Arabia and Babylon, and extended their navigation beyond the Straits of Gibraltar, even, it was

formerly believed, to Cornwall. They settled in some of the islands of the Mediterranean, and planted colonies on the coast of Africa, of which Carthage was the chief. Herodotus says that they circumnavigated Africa.

The Greeks attributed the invention of letters to the Phœnicians, and there is little doubt that the Greek alphabet was derived from them. They attained great perfection in the arts. The Tyrians supplied Solomon with artificers for the building and decoration of his temple (2 Chron. ii.) The form of government appears to have been monarchical. The cities of Phœnicie were originally independent of one another. After the conquest of Samaria and Judea the Phœnicians became successively subject to the Assyrians, Babylonians, and the Persians; and they supplied the chief part of the navy in the war between the Greeks and the Persians. They afterwards were included in the Syrian kingdom of the Greeks, and finally in the Roman province of Syria. Their language was closely allied to the Hebrew, of which we have evidence in coins and inscriptions, and in the testimony of Jerome.

The voyages of the Phœnicians have been fruitful sources of dispute among the learned. Their tin-lands (Gr. *Kassiterides*), which popular tradition will have to mean Cornwall, are now, according to a growing tendency of archaeologists, preferably placed in Spain; and this view is supported by strong philological arguments. Very likely, then, the Phœnicians never reached Britain at all.

The art of the Phœnicians came to bear a distinctly Assyrian type, but late researches, especially those of Monsieur Perrot ("History of Art in Phœnicia," Paris, trans. by Armstrong, London, 1885), show that the first developments were distinctly Egyptian in character, and that its Assyrian modifications mark a recent date in the Phœnician history. The Phœnicians were so exclusively mercantile in their ways that they never developed an independent civilization of their own; they had no specially national characteristics, and consequently no national art. Their constructions were all strictly for use; they sought for economy in all they did; they hated any unnecessary expenditure of time, effort, or money. The remains of their Egyptian or Egypto-Assyrian work lie all round the shores of the Mediterranean, the best sculptures being in Cyprus, and some very good specimens in Malta. In fact the most perfectly preserved examples of the scanty remains of Phœnician sacred architecture are to be found in Malta and Gozo, and fortunately are beginning to be looked after with a view to their preservation, although it is already almost too late. The influence of Phœnician sculpture on Greek art is a most interesting inquiry, recently arising out of the discoveries in Cyprus, and may lead to fruitful results.

As regards the Phœnician language, we are in the unfortunate position that Phœnicia has left us no literature. The most extensive inscription is the inscribed coffin of Ashmanasar II., king of Sidon, about 1000 B.C. (found at Tyre, 1855). The language has therefore to be studied chiefly through coins and funeral inscriptions. This is sufficient to show its close connection with the Hebrew, as to which we have also the testimony of Jerome. The subject was first seriously attacked by Gesenius, "Palæographic Studies on Phœnicia" (Leipzig, 1835), and Movers continued it in his valuable "Phœnizier;" the best general account of the researches up to that date is Kenrick's "Phœnicia" (London, 1855). The curious thing is that we know on undoubted authority that the Phœnician language was at one time spoken more widely than any other tongue save Greek and Latin, and that a copious literature existed almost down to our era, though the original tongue was by that time almost extinct as a spoken language, having become hopelessly corrupt by contact with Greek and Latin. The chief corruption was the western dialect called Punic, often quoted by St. Augustine, and known

to have possessed, among other pieces of literature, an entire translation of the Bible as late as the fifth century A.D. The incursions of the Goths and Vandals destroyed Punic about the sixth century. One of the purest sources for original Phœnician is the Bible itself, where many nouns are imbedded in the sacred text. A long passage also occurs much Latinized, but capable of restoration, in Plautus, in the comedy of "Pamulus" (v. 1.) Finally, many Carthaginian votive tablets have been discovered, and gradually accumulate in museums. The British Museum has the richest collection. The subject still awaits development.

PHŒNIX. See DATE-PALM.

PHŒNIX (Gr. *Phœnix*), one of the most renowned of the fabulous wonders of antiquity, defined by the Arabians to be "a creature whose name is known, its body unknown." The earliest author who mentions it is Hesiod, who merely says that it lives nine times as long as a crow. The first detailed description and history that we meet with is in Herodotus, whose words on that account deserve to be quoted at length. "There is also," says he, in his account of Egypt, "another sacred bird, the name of which is the Phœnix. I have not myself seen it except in a picture, for it seldom visits them, only (as the people of Heliopolis say) every 500 years. And they say that he only comes when his sire dies. And he is, if he is like his picture, of size and shape as follows:—Part of his plumage is gold-coloured and part crimson; and he is for the most part very like to the eagle in outline and bulk. And this bird, they say, devises as follows, but they say what is to me beyond belief, that setting out from Arabia, he brings his sire to the Temple of the Sun; that he covers him with myrrh, and buries him in the Temple of the Sun; and that he conveys him thus: first he forms an egg of myrrh as large as he is able to bear, and afterwards tries whether he can carry it; and when he has made the trial, upon this he hollows out the egg, and puts his sire into it, and covers with other myrrh that part of the egg where he had made the hole and put in his sire; and when his sire lies inside, the weight [of the egg] is the same [as it was before it was hollowed out], and having covered him up, he conveys him to Egypt into the Temple of the Sun. Such are the things which they say this bird performs." This story was, though with various embellishments, repeated and believed for more than a thousand years. The most probable version, and that in connection with which poets and others still refer to it, was that the Phœnix, when about to die, burned itself, and a new and young Phœnix sprang from the ashes.

PHŒNIX, a southern constellation of Bayer, which may be best described as close to, but further from the south pole than, the bright star in Eridanus (Achernes). See CONSTELLATIONS, Southern Hemisphere.

PHŒIOS, PHŒIBE (Gr., the bright and pure, masc. and fem.), Greek epithets of the sun and moon, often used as surnames for the god Apollón and his sister Artemis. The Latin equivalents are Phœbus and Phœbe. The word is connected with *phôs*, light.

PHOKAIA (Lat. *Phocæa*)—not to be confused with PHOKIS (Lat. *Phocis*), which latter was a country in



Gold Coin of Phokaia (Phocæa).

northern Greece—was the northernmost of the great Ionian Greek cities of Asia Minor, just above what we now call

the Gulf of Smyrna. It was traditionally said to be founded by a colony from Phôkis. Its fine harbour gave Phôkaia a great maritime power, and it founded many colonies, of which the chief was Massilia (now Marseilles), in the south of Gaul, and on the Spanish coasts. After the Persian conquest the great bulk of the population emigrated to Corsica; but even then the city remained very wealthy, and the Romans when they conquered Asia found rich plunder in Phôkaia. A very early gold coinage is found dating from this city, an illustration of one specimen being given below. The seal (Gr. *phôkê*) is seen upon the obverse, and only the mark of the coining anvil on the reverse, as is usual with very antique coins, which were all struck with a hammer.

PHŒKION, an Athenian general and statesman, very distinguished, though of humble origin, was a contemporary of Demosthenês, and a scholar and friend of Plato. He was born B.C. 402. His first appearance in history is at the battle of Naxos, B.C. 376. He was the representative of that party in Athens to which Demosthenês was the constant antagonist, for while the great orator stood out for an uncompromising opposition to Philip of Macedon, Phôkion, with a wiser estimate of the power of Athens, as constantly advocated peace, if honourable terms could be obtained.

To a stern and forbidding aspect, a stoical demeanour, and habits of rigid simplicity, he united a kind and generous heart. These qualities secured for him so great a measure of popularity that he was forty-four times elected general, and that in an age when public offices were generally obtained by bribery. He was also heard with so much attention in public, that even Demosthenês dreaded the effect of his terse and pithy harangues. Alexander had the greatest regard for him, and it was greatly owing to this that Athens received such good treatment at his hands. He pressed Phœkion to receive handsome gifts for his influence towards peace, but the latter begged leave to decline them, or to substitute the release of a few prisoners for them, that "the king might leave him as honest as he found him."

Plutarch records many of his sayings, which contain much wit and point, and a great deal of political wisdom. Phœkion often led the Athenian armies, and successfully; but he seems to have acted the part of an ambassador even better than that of a general. He was put to death (B.C. 317) on a groundless accusation of treason.

PHŒLAS. See PHŒDOCK.

PHONETIC WRITING. Alphabetic writing is in principle phonetic writing, but in practice all modern languages are written more or less unphonetically: the English language is the worst in this respect. The principal languages of modern Europe conform to phonetic laws, that is, the spelling directs to the pronunciation, in something like the following order:—Dutch, Spanish, German, Italian, French, English. During the last twenty years, by the wide diffusion of phonetic shorthand writing, invented by Mr. Isaac Pitman, and the publication by him of a weekly journal printed in a phonetic alphabet, phonetic writing has become a popular study in this country, and is no longer supposed to be some mysterious kind of Egyptian writing. This fact encourages us to hope that the genius of reform has at length laid her hand upon the English language for the purpose of simplifying its orthography. In order clearly to exhibit the principle and the practice of phonetic writing, it will be necessary to show how far our language, as now written, is phonetic, and wherein it is not.

Each letter of the alphabet is the representative of a sound, vocal or consonantal; thus, *a* is the representative of the short vowel heard at the commencement of *at*, in the middle of *lap*, and at the end of *manna*. *B* represents the closure of the lips necessary to produce the

words *bec, abbey, ebb*. Let this principle be carried out with respect to every open sound, called a vowel, and every interruption of such sound, called a consonant, and the result is phonetic writing.

As we proceed with the alphabet we find that *e* is not the sign of one sound, but of three. (We speak of the consonants as *sounds* for brevity, and in accordance with the popular notion of them.) In *eat, sac* (a bag), it represents *k*; in *cent, face*, it represents *s*; and in *facial, social*, it represents a sound similar to *s*, but thicker, so to speak, and is commonly written *sh*.

We shall not have proceeded even thus far in the alphabet without discovering that *a* and *b* are not uniformly employed as above. We shall find that *a* represents five distinct sounds, not in single words only, but in classes of words; and that *b* is written in some words where it is not spoken, as in *dumb, tomb, lamb*, and about a dozen others. The five different sounds of *a* are heard in the words *fat, fate, father, fall, want*. If the reader will look through the first paragraph of this article he will find that *a* is sounded as in *fat* fifty-four times; as in *fate*, nine times; as in *father*, not once; as in *fall*, once; and as in *want*, twice.

The other four vowel types also represent two or three sounds each, in classes of words; thus,

<i>E</i>	is pronounced differently in	<i>me, met.</i>
<i>f</i>	"	" <i>pine, pin.</i>
<i>o</i>	"	" <i>no, more, not.</i>
<i>U</i>	"	" <i>tube, fun, full.</i>

There is, however, one sound to each vowel which occurs so frequently that it may be called the proper or standard sound of the letter, all the other sounds or powers being irregular. It is that short sound which the vowel receives in a syllable closed by a consonant; as, for instance, in *pat, pet, pit, pot, put*. The letter *u*, in English, represents the sound heard in *but* more frequently than that in *put* (pööt). In the phonetic alphabet, exhibited below, it represents the latter sound; and a new type is introduced for the *but* vowel.

The five letters, *a, e, i, o, u*, besides representing fifteen different sounds in large classes of words, have also many irregular duties to perform; thus,

A represents *e* in *any, many*.

E is sounded *i* in *England*, and is not sounded at all in *George*.

I represents *e* before *r* not followed by a vowel; thus, *sir, fir*, are pronounced like the first syllables of *sermon, ferrent*.

O is sounded like *i* in *women*, like *öa* in *woman*, and is silent in *leopard*.

U is silent in *guild, quina, guess*, and is pronounced *öa* after *j, l, and r*, as in *June, lute, rule*. (*Jün, lüt, rül*, with the diphthong of *tune*, would be provincial.)

These are but specimens of the vagaries of English orthography. Every letter of the alphabet is either used for purposes which do not pertain to it as the type of a certain sound, or has its proper sound represented by some other letter. The standard sounds of the twenty-six letters of the English alphabet are shown in the following words:—

a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z,
at, are, pass, be, can, do, edge, err, for, go, he, it, jet, key, let, (kay)

m, n, o, p, q, r, s, t, u, v, w, x, y, z,
ue, no, not, nor, pie, queen, rout, so, to, put, full, vie, wet, (kween)

X, Y, Z,
fox, yet, zel.

From this view of the powers of the letters it will be seen that *e* and *q* are additional representatives of the

sound of *k*, and that *x* represents *k* and *s* united. These three letters are therefore unnecessary in a phonetic alphabet, which, though it need not be restricted to the representation of simple or single sounds, should not include letters for double sounds except for obvious purposes of utility.

The twenty-three phonetic signs or letters which remain are inadequate to represent the language on the principle of a sign for each distinct sound. Including the two diphthongal sounds *eh, j* (as in *cher, jeer*), there are thirty-six distinct sounds in the English language. There is therefore a deficiency of thirteen letters, which must be supplied before the language can be represented phonetically. Of these, six are the long vowels,

ah, eh, ee, aw, oh, öö,

heard in *path, pair, peat, paw, boat, pool*, which are in some cases absolutely, and in other cases nearly, the lengthened sounds of the short vowels,

a, e, i, o, —, u,

heard in *pat, pet, pit, pot, but, put.*

The greatest difference of sound is heard in the fifth pair, *boat, but*.

The combinations

ei, au, ou, ai, oi

represent the diphthongs in

by, new, now, Kaiser, coil.

There are required, then, six types for the six long vowels, and one for the short vowel in *but*.

In the consonants our alphabet requires six more letters, for the sounds heard in *cheer, she, vision, thin, then, sing*.

In this article we confine ourselves chiefly to an exposition of the phonetic alphabet employed in the *Phonetic Journal* issued by Mr. Pitman, of Bath. For an exposition of his phonetic shorthand, see *SHORTHAND*. The following is the Phonetic Alphabet, together with specimens of phonetic printing and writing. The phonetic letters in the first column are pronounced like the italic letters in the words that follow. The last column in the alphabet contains the names of the letters. The illustrative passages are taken from Bacon's 'Essays.'

THE PHONETIC ALPHABET.

CONSONANTS.

Mutes.	Liquids.
P p...rope, post.....pi	L l...fall, light.....ol
B b...robe, boast.....bi	R r...more, right.....ar
T t...fate, tip.....ti	Coaleseents.
D d...fade, dip.....di	W w...wet, quit.....we
G g...cheap, fetch.....ge	Y y...yet, use (yuz) .ye
J j...jump, bridge.....je	Aspirate.
K k...leek, cane.....ke	H h...hay, house.....eg
G g...league, gain.....ge	FOWELS.
	Gutural.

Continuants.	A a...am, first, far...at
F f...safe, fat.....ef	A a...alm, father....a
V v...save, vat.....vi	E e...ell, any, her...et
H h...wreath, thigh....i	E e...ale, fair, bear...e
I i...wreath, thy....di	I i...ill, pity, filial...it
S s...hiss, seal.....es	J j...eel, cat, mero...i
Z z...his, zeal.....zi	Labial.
X x...vicious, sho.....if	O o...on, not, nor...ot
Z z...vision, pleasure...zi	O o...all, law, ought...o
Nasals.	S s...ap, son, cur...st
M m...seem, met.....em	O o...ope, coat, pour...o
N n...seen, net.....en	U u...full, foot.....ut
U u...sing, long.....iy	U u...do, food, tour.. u

Specimen of Phonetic Printing.

Stadiz serv for deleit, for ornament, and for abiliti. Her gif yus for deleit iz in preivates and reiteirig; for ornament, iz in diskors; and for abiliti, iz in de jsjment and dispozifon ov biznes; for eksepert men kan ckeekiut, and perhaps jsj ov partikularz, wsn bei wsn: bst de jeneral kounsels, and de plots and marsjalig ov alferz, ksm best from doz dat ar lerned. Tu spend tq msq teim in stdiz, iz sled; tu yuz dom tu msq for ornament, iz afektefjon; tu mek jsjment hollu bei der ruz, iz de yimor ov a skolar; de perfekt netiur, and ar perfokted bei ekspjriens—for natural abilitiz ar leik natural plants, dat njd prunig bei stdi; and stdiz deinselvz du giv forj direkfonz tq msq at larj, eksept de bj bounded in bei ekspjriens. Krafti men kontein stdiz, simpel men admeir dem, and weiz men yuz dem; for de tjs not der om yus; bst dat iz a wizdom widout dem, and absv dem, wsn bei obzervefjon. Rjd not tu kontradikt and konflikt, nor tu beljv and tek for granted, nor tu feind tok and diskors, bst tu we and konsider. Ssm buks ar tu bj tested, sderz tu bj swolod, and ssm liu tu bj gud and dijested: dat iz, ssm buks ar tu bj red onli in parts; sderz tu bj red, bst not kiurisli; and ssm liu tu bj red hollu, and wid dijens and atenfjon. Ssm buks olsv me bj red bei depiuti, and ekstraks med ov dem bei sderz; bst dat wud bj onli in de les important arguments, and de mjner sort ov buks; els distild buks ar, leik komon distild woterz, flaji jingz. Rjdij mekel a ful man, konferens a redi man, and reitig an ekzakt man; and derfor, if a man reit litel, hj had njd hav a gret memori; if hj konfor litel, hj had njd hav a prezent wit; and if hj rid litel, hj had njd hav msq ksnij, tu eim tu no dat hj dsj not.

Specimen of Phonetic Longhand.

If de invenfjon ov de fjs woz bot so nobel, hwig hariesz rizez and komoditiz from ples tu ples, and konsietel de most remot rjjonz in partiojefjon ov der frys, hau mrg mor ar letersz tu bj magnifit, hwig az fjs, pas bry de vast spz ov teim, and mek ejes so distant partiojfel ov de wizdom, slyminefonz, and invenfonz, de urn ov de rder.

The following paragraph contains all the letters of the Phonetic Alphabet:—

Bei de Fonelik Alfabet eni person, old or yrg, me bj bot tu rjd bot in fonelik and in ordinari buks, in bry mends,—ai, often in twenti ours' insturkfon,—a task hwig iz verli akamplif in bry yjra ov tolt bei de old alfabet. Hwat fader ar tjger wil not hel dis gret byn tu edukefjon?—dis powerful masjn for de difuzjon ov noles!

Any enlargement of the alphabet must necessarily be accompanied by a re-arrangement of its letters, for the thirteen new letters could not, with any congruity, be placed either before or after the other letters, nor be intermingled with them. The principle on which the sounds of the language, or the letters of the phonetic alphabet, have been arranged, as exhibited below, is this:—The consonants precede the vowels, because they form the body of the language. Both consonants and vowels are subdivided into classes according to their organic formation; and the members of each class of consonants are placed in the order in which the organs that produce them follow each other, from the entrance of the mouth to its closure in the throat.

The following observations on the preceding alphabet occur in Max Müller's second series of 'Lectures on the Science of Language.'

"I ought not to omit here to mention the valuable services rendered by those who, for nearly twenty years, have been labouring in England to turn the results of scientific research to practical use, in devising and propagating a new system of 'Brief Writing and True Spelling,' best known under the name of the *Phonetic Reform*. I am far from underrating the difficulties that stand in the way of such a reform, and I am not so sanguine as to indulge in any hopes of seeing it carried for the next three or four generations. But I feel convinced of the truth and reasonableness of the principles on which that reform rests; and as the innate regard for truth and reason, however dormant or timid at times, has always proved irresistible in the end, enabling men to part with all they hold most dear and sacred, whether coin laws, or Stuart dynasties, or papal legates, or heathen idols, I doubt not that the effete and corrupt orthography will follow in their train. Nations have before now changed their numerical figures, their letters, their chronology, their weights and measures; and though Mr. Pitman may not live to see the results of his persevering and disinterested exertions, it requires no prophetic power to perceive that what at present is pooh-poohed by the many will make its way in the end, unless met by arguments stronger than those hitherto levelled at the 'Fonetic Nuz.' One argument which might be supposed to weigh with the student of language, namely, the obscurity of the etymological structure of words, I cannot consider very formidable. The pronunciation of languages changes according to fixed laws, the spelling is changed in the most arbitrary manner, so that if our spelling followed the pronunciation of words, it would in reality be a greater help to the critical student of language than the present uncertain and unscientific mode of writing."

Phonetic alphabets have been invented and used by the following writers, and many others of less note:—

Sir John Cheke, 1520. He translated the Gospel of Matthew, and wrote it in phonetic spelling, or a reformed orthography. It was edited by the Rev. J. Goodwin from the author's manuscript, preserved in the library of Corpus Christi College, Cambridge, and printed in 1843 (London, Pickering). (Strype's "Life of Cheke," and *Phonetic Journal*, 1855, p. 434.)

Sir Thomas Smith, 1550 (?). His alphabet is given in the *Precursor* (London, Pitman), 1851, p. 50; and some account of it may be seen in the *Phonetic Journal*, 1850, p. 215; 1851, p. 22.

John Hart, 1569. But one copy of Hart's work is known to the writer to be extant, and that one is in the British Museum. It was reprinted in 1850 by Pitman (London), partly in phonetic shorthand, and partly in longhand, with the author's new letters. Hart's book is sometimes mentioned as having been written by J. H. Chester, but Chester was the place where Hart resided. He was employed in the Herald's Office there. It is invaluable for

the information it gives of the pronunciation of our language 300 years ago.

Bishop Wilkins, 1668. His work, published at the mature age of fifty-four, is entitled "An Essay towards a Real Character and a Philosophical Language." It is a goodly folio, and was printed by order of the Royal Society, of which Wilkins was an active member. His phonetic alphabet holds a very subordinate place in his grand scheme, his main object being to recommend the adoption of a new and philosophical language.

Benjamin Franklin, 1768. ("Franklin's Works," in three volumes, vol. ii., p. 357.) Franklin's alphabet, and the correspondence that passed between him and Miss S—— [Stevenson] upon it, and was written phonetically, are given in the *Phonotypic Journal*, 1814, p. 70; and in the *Phonetic Journal*, 1859, p. 67.

John Faulder, Bristol, 1847. (*Phonotypic Journal*, 1847, p. 70; and *Phonetic Journal*, 1852, p. 114.)

Lepsius also constructed a phonetic alphabet, which is employed, with variations, in several missionary stations.

George Edmunds, 1856. Mr. Edmunds, emulating Bishop Wilkins, invented, as the title of his work runs, "A Universal Alphabet, Grammar, and Language" (London, Griffin). It is a thick quarto volume. (*Phonetic Journal*, 1856, p. 371; and 1858, p. 81.) At the latter reference will be found a full account of the scheme, and a comparison of it with Wilkins's "Philosophical Language."

Tito Pagliardini, 1864. "Essays on the Analogy of Languages. The International Alphabet; or a Plea for Phonetic Spelling" (London, Pitman). This is a lively and forcible defence of the principle of a phonetic representation of language.

J. G. Thomson, 1859. "An Unpointed Phonetic Alphabet, based upon Lepsius's Standard Alphabet, but easier to read and write, and less likely to be mistaken; cheaper to cast, compose, correct, and distribute, and less liable to accident." By J. G. Thomson, Madras Civil Service, Mangalore." (*Phonetic Journal*, 1860, p. 157; 1862, pp. 708, 717.)

But the most persistent effort at phonetic printing in the present century, next to Mr. Pitman's, was made by Dr. Comstock, of Philadelphia, who published his alphabet in 1846, declared to be perfect, no change or improvement being made in it as the result of experience.

In 1877 the London School Board proposed that a Royal Commission should be issued with a view to an improvement in the method of spelling in the schools under their control; and this suggestion led to considerable discussion of the merits of the phonetic system as a substitute for the alphabet at present in use. Opinions were found to be very much divided on the matter, and practical men generally came to the conclusion that the difficulties to be overcome rendered it practically impossible, even if it were thought desirable, to effect any improvements in this direction.

Phonetic science, as the basis of a phonetic alphabet, has been pursued, and results of various degrees of accuracy obtained, by the following and many other writers:—

English.—Arnold, Alexander Melville Bell, Darwin, De Stains, Donaldson, A. J. Ellis (Mr. Ellis worked in conjunction with Mr. Pitman in the formation of a phonetic alphabet and the introduction of phonetic spelling from 1843 to 1849), Elphinstone, Herschel, Holder (1669), Holdsworth and Aldridge, Sir W. Jones, Latham, Lyle, Max Müller (the most eminent living authority on phonetics and the science of language), Mitford (author of the "History of Greece"), Sheridan, Smart, Horne Tooke, Walker, Wheatstone, Professor R. Willis, and Dr. Thomas Young.

Foreign.—Becker, Bopp, Cubi, Flügel, Fürst, Grimm, Haldeman, Kaltschmidt, Kempen, Klopstock, Kratzenstein, Schmittmeier, Thibaudin, Volney.

PHONOGRAPH, the name given by its inventor, Mr. T. E. Edison, of New Jersey, to a remarkable machine for recording and reproducing sound. The phonograph had its origin in connection with the telephone, for it was while Mr. Edison was experimenting with the latter instrument that the idea of the phonograph occurred to him. The nature of the articulate tones of the human voice is explained in our article **PHONOLOGY**. The instrument devised by Edison is intended to *stereotype* these voice vibrations, and thus enable them to be at any time reproduced. The apparatus is alike remarkable for the extreme simplicity of its construction and the surprising results which it produces.

It consists essentially of a brass cylinder (A, fig. 1 in our Plate) about 10 inches long and 3 in diameter, on the surface of which there is a very accurately cut spiral groove of a V shape, the threads of which are about one-tenth of an inch apart. This cylinder is mounted on an axis, B, turned at one end into a screw of the same pitch as that of the groove on the cylinder. The axis is either turned by means of a handle, while the regularity of the motion is maintained by means of a heavy fly-wheel, or it is driven, as shown in our Plate, by a weight acting on a train of wheel-work, the speed of the whole regulated by an adjustable "fly." A sheet of tinfoil is fastened smoothly round the surface of the cylinder, and a mouth-piece, of the form shown at C, is placed close to the latter, supported in such a way that its distance from the surface of the cylinder may be readily adjusted. The mouth-piece directs the sound-waves of the voice against a thin elastic metal disc (shown in figs. 3 and 4), about one-hundredth of an inch in thickness. At the back of this plate there is a small steel point (fig. 5), carried by a lever-spring, and connected with the centre of the disc by a wire which is interrupted by one or two small pieces of india-rubber tubing, to deaden the vibrations. The point is so adjusted that it gently presses against the surface of the tinfoil just over the spiral indentation of the groove. Any vibrations therefore of the disc will be transferred to the steel point by means of the piece of rubber tubing. If the cylinder be now set in motion, the screw thread on its axis causes it to move lengthways as it rotates, thus keeping the spiral groove always under the point. When the metal diaphragm is at rest and the cylinder in motion, the point marks a spiral line of uniform depth on the tinfoil. When the disc, however, is made to vibrate by speaking or singing into the mouth-piece while the cylinder is kept in motion, a series of dots or indentations are produced on the tinfoil (shown magnified in fig. 2), the depth of which will represent the densities of the different portions of the sound-waves intercepted by the disc. The tinfoil, being a non-elastic substance, retains these markings permanently. Although they appear to the eye as a series of dots or points, yet, when examined by the microscope, they are each seen to have a distinctive form, and a longitudinal section presents an outline closely resembling the jagged edge of a König's flame.

After any utterance has been thus recorded on the tinfoil, if the point be removed, the cylinder set back in its original position, and the point again brought into contact with the tinfoil in the same spot as at first, the part which the mouth-piece performs will be reversed. Its diaphragm will be caused to vibrate when the cylinder is turned, by the point passing over the indentations in the tinfoil. The vibrations thus set up in the diaphragm are communicated to the air by the mouth-piece, and the articulate sounds of the voice are reproduced.

To produce the best effect in thus translating the indentations of the tinfoil, a larger disc and mouth-piece are found preferable. When the elastic diaphragm is thin, greater loudness is obtained, while a rather thicker disc gives increased distinctness, but less power. The quality

and tones of the speaker's voice are very accurately reproduced, but with a certain nasal intonation. The sound may be reproduced more than once from the original tinfoil; but after the second time, the voice becomes weaker, owing to the pressure of the point destroying the delicate impression on the tinfoil. It is obvious, however, that by the process of electrotyping, copper casts may be taken from the tinfoil, which are much more durable, and may even be stored away for years and brought into use at pleasure.

If the velocity of rotation of the cylinder is not maintained, the *pitch* of the voice is altered, being raised by every increase in velocity. Hence, if the motion is not uniform, the reproduction of a song, for instance, must be incorrect. There is also a considerable difference in the distinctness with which some of the consonants and vowels are enunciated. The *s* is very difficult to reproduce successfully.

When the phonograph was exhibited from a raised platform at one end of the large room of the Royal Society of London, before several hundred persons, the reproductions of the different speakers' voices were ludicrously accurate. Passages from Shakespeare were recited by the instrument, and the National Anthem was given with such vigour and effect that it received an encore.

If two or three persons sing the different parts of a song at the same time into the mouth-piece, the tinfoil picks up the combined vibrations in a wonderful manner, and the song is reproduced by the phonograph as either a duet or trio as the case may be.

Edison has stated that 40,000 words can be registered by this remarkable instrument on a space 10 inches square.

PHONOLITE (Gr. *phōnos*, sound; *lithos*, stone), or *Clinkstone*, a micro-crystalline igneous rock, having a ringing sound when struck with the hammer, and consisting essentially of orthoclase felspar (sanidine), hornblende, and the mineral nepheline. This rock is an old lava, containing upwards of 60 per cent. of silica.

PHONOLOGY, sometimes also called *Phonetics*, is the science which deals with the elementary spoken sounds of language; and its principal divisions are—firstly, the ascertaining of how many various sounds a language contains, and secondly, of the means of representing those sounds by combinations of signs. Taking the English language of the present day as an example of this most interesting branch of science, it teaches us that we possess in all forty-five sounds, which are composed of fourteen pure vowels, five mixed vowels or diphthongs, two aspirates, and twenty-four consonants.

The fourteen pure vowels are as follows:—*a* in fat, *a* in far, *a* in fane, *a* in far, *a* in fall, *a* in want; *e* in met, *ee* in meet; *i* in pit; *o* in not, *o* in note, *oo* in food (also *u* in rude), *oo* in wood (also *u* in put); *u* in nut. The five mixed vowels or diphthongs are *i* (really *ai*) in high, *i* in fine, *oi* in boil, *ow* in how, *ew* in few. It is questionable whether *o* in note should not be reckoned a diphthong, since it really sounds *o-oo*, *no-note* and not the pure long *o*. The two aspirates are *h* in house and *wh* (i.e. *hw*) in when.

The twenty-four consonants are made up of thirteen spirants and eleven mutes. The spirants contain one guttural, *ch* as in loch (Scottish); one palatal, *y* in yea; two dentals, *th* in breath and *th* in breathe; four sibilants, *s* (or *c*) in racer, *z* (or *s*) in razor, *sh* (or *s*) in erasure, *zh* (or *s*) in pleasure; two trills, *l* in lip, *r* in rip; three labials, *f* in fat, *v* in vat, *w* in word: thirteen altogether. The mutes contain three gutturals, *k* (or *c*) in cot, *g* in got, *ng* in king; two palatals, *ch* in church, *j* (*dy* or *d*) in judge; three dentals, *t* in ten, *d* in den, *n* in net; and three labials, *p* in pen, *b* in ben, *m* in men: eleven altogether. It is observed that *c* is left out since it either means *s* or *k*; and the soft sound of *g* (in general), because it means simply *j*;

q because it has no independent sound, and in its invariable form *qu* is already given as *kw*; and *x*, which is either the compound *ks* in express, or the compound *gs* in exact.

Examining these classes from another point of view we find them distinguished as follows. The vowels are purely produced by means of adjustments of the vocal chords and the cavity of the mouth. If the jaws be separated and the throat thrown open, the tongue lying quite quiescent, so that the entire vocal cavity is funnel-shaped from the larynx to the lips, we get the broad Italian *a* (our *a* in far); if we hollow the tongue, bring the jaws closer, round the lips, and get the whole vocal cavity as cylindrical as possible, say like a bottle without a neck, we produce *o*; if we now pout the lips, thrusting forward the chin slightly and drawing the cheeks closer, so that the whole cavity is made as pipe-like as possible in form, we get the Italian *u*, our *oo* in fool. On the other hand, starting from *a* in far, if we draw apart the lips, lessening the aperture of the jaws somewhat, and shifting the tongue so that the root is depressed and the middle is elevated, we get the Italian *e* (our *a* in fare), the cavity now resembling a bottle with a narrow neck; if we exaggerate these conditions, enlarging the "bottle" and further narrowing the "neck," we produce the Italian *i* (our *ee* in fee). All these vowel positions are well visible with the laryngoscope. The various positions give very characteristic resonances, or *vowel-tones*; so much so that on raising the dampers of an open piano-forte and singing a vowel into it with the full force of the voice (at any comfortable pitch), not only the note sung but the vowel sung is echoed from the vibrating strings, and a ghostly *oo* or *ah* or *ee* issues as from an invisible mouth. [See this interesting subject further treated of in the article *VOWEL TONES*.] Between the positions of the mouth which have been named there is an infinity of grades, in the series *A E I* on the one hand and the series *A O U* on the other; and the musical test supplies at once a perfectly accurate and a very easy means of distinguishing the slightest modification due to individual or race peculiarities.

The diphthongs are due to a gliding change in the vocal cavity from one position to another during a vowel sound; and therefore are chiefly producible from the *a* position, or from one closely akin to it. Still keeping to the Italian vowels, as we have hitherto done, a gliding change from *a* (far) to *e* (men), gives us the English diphthongal *i* in fine, while a more extended change gives us our other diphthongal *i*, that in high. So also a passage from the English *a* in fan, to the English *oo* in fool, yields the diphthongal *ow* in how; and a passage from the English *a* in fall to the *i*-position, the English *ee* in fee, yields the diphthongal *oi* in boil. Passing from *o* to *oo* (continental *u*) we get the long English *o* of very diphthongal character, as in note, stone, &c. The other diphthong in our tongue, *ew* in few, is gained by a gliding change from the *i* to the *ee*-position, or from English *ee* to English *oo*.

Consonants are scarcely so much sounds as noises, or interruptions, partial or total, of the true sounds of the vowels. Some consonants are simply due to various modes of closure of the air-passage; these are called *mutes*—*k*, *g*, *d*, *t*, &c. Ranging under the mutes, but distinguished from them by the posterior nares still remaining free, so that a certain amount of stifled sound issues by the nose, are the *nasals*—*n*, *ng*, *m*. If the breath be only checked by a more or less partial closure, we have the *spirants*—*th*, *f*, *v*, &c. The *labials* are due to a trilling motion of the tip of the tongue (*r*) or of the uvula (*l*). If the breath be allowed to pass as in ordinary respiration just before the vocal organs contract into operation the simple aspirate sound *h* is given, which becomes *wh* (i.e. *hw*) if the lips are brought into the *o*-position. If instead of the open *h*-position the tip of the tongue be brought close to the teeth, a hissing sound is produced, and we

have the *sibilants*—*s*, *z*, or if the middle of the tongue approach the palate we have the duller sibilants—*sh*, *zh*. These various classes of sounds may be modified by more or less vigorous action of the vocal organs, and hence are often found in pairs, distinguished as *surds* and *sonants*, the latter being the less vigorous consonantal form. For instance, *p* is the surd labial mute, *b* is the sonant; *sh* (sharp) is the surd sibilant spirant, *zh* (vision) is the sonant.

To express all the varieties of sound above given, vowels and consonants together, we have only twenty-six letters, out of which three are redundant, leaving a workable alphabet of twenty-three. The case is thus seen to be bad enough for the comparatively limited English alphabet, but it is painfully ridiculous when with our few symbols we seek to produce the vowel modifications of the Sanskrit, the consonantal "clicks" of the Hottentot, and even the moderate variations of sound necessary in the simpler tongues of our neighbours.

PHORMIUM is a genus of plants of the order **LILIACEÆ**, containing only a single species, *Phormium tenax*, remarkable for its useful product, so well known under the name of the New Zealand flax, and which is found indigenous in New Zealand, the Chatham Islands, and Norfolk Island. It has been introduced as an ornamental garden plant into Europe. The leaves, which are used by the natives for making clothes, ropes, &c., spring in tufts from the extremity of a rhizome; they are sword-shaped, and from 3 to 6 feet in length. The flower spikes are from 6 to 16 feet high, springing up from the centre of the leaves. The flowers are tubular and orange-coloured. See **FLAX**, NEW ZEALAND.

PHOSPHATES. As hereafter explained, when phosphorus undergoes combustion in oxygen gas, a substance known as phosphoric acid (HPO_3) is obtained. This acid, in combination with alkalies, earths, and metallic acids, forms salts denominated phosphates, which play an important part in the constitution of the human body. The principal phosphates are those of sodium, calcium, potassium, ammonium, and magnesium. These, but chiefly two or three of them, play a most important part as constituents of the soil. This will be seen, if we remember the quantity of phosphoric acid which certain well-known vegetables remove from the soil, and the necessity of returning it again by means of the manure put into the ground before it is cropped. In 100 parts of the ashes of grain phosphoric acid occurs in the following proportions:—

	Per Cent.
Wheat,	50
Barley,	39
Oats,	41
Beans,	38
Peas,	34

The same important fact is illustrated if we take the ashes of straw:—

	Per Cent.
Wheat,	3
Barley,	3
Oat,	3
Bean,	12
Pea,	8
Red clover,	8

The power of certain roots to abstract phosphoric acid from the soil is equally suggestive:—

	Per Cent.
Potatoes,	13
Turnips,	8
Beet,	8
Carrots,	16
Cabbages,	12
Turnips,	9

The following table shows the amount of phosphoric acid removed per acre for some ordinary crops:—

Corn crops, . . .	{ Wheat,	23 lbs.
	{ Barley,	20 "
	{ Oats,	16 "
	{ Turnips,	20 "
Root crops, . . .	{ Swedes,	17 "
	{ Mangolds,	23 "
	{ Beans,	29 "
Leguminous crops, . . .	{ Clover, hay,	28 "

This loss must be returned artificially, and the manures which contain most of it are best adapted for meeting the poverty of soil brought about by such crops. This fact has led to the present large use of phosphates as artificial manures. In combination with calcium, phosphoric acid forms bone, and thus the value of bone manure in certain circumstances as a fertilizer, because phosphate of calcium forms the base of the constituents of the bones of animals. It is also an important constituent in Peruvian guano.

Mineral phosphates are also used extensively for manures, such as coprolites, apatite, and redondo phosphate. The two former are phosphates of calcium, and the latter is phosphate of aluminium. The mineral phosphates are usually rendered soluble by treating them with sulphuric acid, and are then known as superphosphates or soluble phosphates, which have become commercial products of great and increasing importance.

PHOSPHATIC DEPOSITS, when of any considerable extent, are of great economic importance as furnishing a valuable manure. A most recent accumulation of this nature is the **GUANO** of the West Indies and certain isles of the Pacific Ocean. This consists of the excrement of sea-birds, mingled with the bones of fishes, &c., and is now in process of being formed. But several important deposits of similar chemical composition are met with in rocks of ancient geological date, and some are sufficiently extensive to be largely worked for commercial purposes. A few owe their origin to the accumulation of the excrement of animals, technically known as **COPIROLITES**, while others consist of nodules of phosphate of lime (often erroneously referred to under the same name), which are really concretionary structures. [See **NOBLES**, **CONCRETIONARY**.] In England the "coprolite diggings" of Cambridgeshire yield the most important supply of phosphatic nodules at the present time, and these are nearly all of concretionary origin. They occur in beds in the Cambridge greensand, immediately above the gault. The Neocomian strata, near Pottou, in Bedfordshire, and near Farringdon, in Berkshire, are also characterized by accumulations of phosphatized fossil remains; these are likewise quarried for agricultural purposes; so also are the phosphatized fossils occurring in certain layers of the red rag of Suffolk. Phosphatic nodules are further met with in the middle Lias to the south of Lincolnshire, and in less abundance in many other marine strata. The massive variety of phosphate of lime, known as *phosphorite*, is also particularly worthy of note, being found in enormous quantities in Estremadura, Spain, and to a less extent in Quercy, Central France. In each case the ground mineral phosphate is mixed with about two-thirds of its weight of sulphuric acid, to convert it into the "superphosphate of lime" of commerce.

PHOSPHORES'CENCE is the property which some bodies, organic and inorganic, possess of being luminous in the dark without the emission of sensible heat. The causes of this phenomenon are various. Phosphorescence has no necessary connection with phosphorus; indeed the first phosphorescent object, the Bologna stone, was obtained before the discovery of that element. The Bologna stone was sulphide of barium, produced by a cobbler of Bologna

at the beginning of the seventeenth century from heavy-spar, by heating it with charcoal. This substance was phosphorescent after *insolation*, that is, after exposure to the sun's rays it emitted light in darkness. Phosphorescence after insolation is also exhibited by sulphide of calcium, phosphate of lime, calcined shells or pearls, diamonds, and indeed to a greater or less degree by almost all terrestrial objects except metals. Balmain's luminous paint, a coating of which renders objects visible in the dark, consists mainly of sulphides of barium and calcium. Some substances become phosphorescent by heat, as fluor-spar and diamonds; others by mechanical action, as mica by cleavage, quartz and flint by friction. When water is allowed to freeze rapidly a brilliant spark is produced. Electricity also gives the property of phosphorescence after insolation to bodies which did not before possess it; this is the case with rarefied air, and various gases, as oxygen and hydrogen. Drops of rain in violent storms have been observed to emit sparks of light; and many instances have been recorded of luminous fogs or mists. The well-known *Ignis fatuus* or *Will-o'-the-Wisp*, attributed by Kirby and Spence to luminous insects, is probably, in most cases at least, due to the combustion of marsh gas, the faint flame being invisible by day.

Organic phosphorescence.—Some plants have exhibited the power of emitting light; and here the property seems to be dependent on the respiration of oxygen. The first observation on this subject was made by the daughter of Linnaeus, who observed that the flowers of the garden Nasturtium (*Tropaeolum majus*) emitted sparks in the twilight in June and July. This phosphorescence has been observed in other yellow or orange-coloured flowers, as the Marigold (*Calendula officinalis*) and the Orange Lily (*Lilium bulbiferum*). It is to this phenomenon that Coleridge alludes in the following lines:—

"'Tis said, on summer's evening hour,
I flash'd the golden-coloured flower,
A fair electric flame."

Many authorities, however, assert that this is an optical delusion arising from the peculiar effect of orange tints on the eye. Among fungi phosphorescence is exhibited by some agarics and rhizomorphs. In the coal-mines near Dresden *Rhizomorpha subterranea* is so numerous as to dazzle the eye by its brilliant light. Rotten wood is also known to be phosphorescent, the luminosity being in this case due to the presence of the ramifying mycelia of fungi.

Decaying animal bodies are frequently luminous. The body of a mackerel or a herring in this state will be found to be covered with an oily luminous substance, which contains no fungi nor animalcules nor phosphorus.

Phosphorescence is exhibited by a large number of animals, and in some cases seems to be due to the slow combustion of phosphoric fatty matter.

The well-known phosphorescence of the sea is due to the presence of animals, chiefly to myriads of an infusorian, *Noctiluca miliaris*, which swarm on the surface of the sea. Other infusorians contribute, such as *Peridinium* and *Ceratium*, and also jelly-fish, the beautiful *Cestum veneris*, and the Sea-pens (*Pennatulæ*). *Pyrosoma*, a floating colony of tunicates, resembles a cylinder of glowing phosphorus; the luminous organs are two patches of fatty cells at either end of the body. The nearly-allied *Salpeæ* are also luminous. The phosphorescence of the Piddock (*Pholas*), a rock-boring mollusc, was known to Pliny; and the dead body long retains this property. Phosphorescence is exhibited by various species of brittle-stars, crustaceans, and pteropods, and also by many of the larval forms that are found on the surface of the sea. It is said that the earth-worm possesses this property in its clitellum, the swollen anterior portion of the body, and that it serves as a sexual attraction, as in the case of the glowworm. Two species of centipedes, one of which, *Scolopendra electrica*, is not uncommon in England, are highly phosphorescent.

The luminous insects have been already considered in the article FIRE-FLY. It will be enough to say here that they include the Glowworm (*Lampyris noctiluca*) and various species of Elateride, in both of which the luminosity is due to a process of slow combustion. The luminosity of the Lantern-fly (*Fulgora*) has been disproved.

Some deep-sea fishes possess large shining eye-like bodies embedded in the skin, either placed on the head or distributed along the sides of the body. Some of these fishes (*Scopelus*) possess large eyes, but others are blind; but in both cases probably these bodies are luminous.

PHOSPHORIC ACID. See PHOSPHORUS.

PHOSPHORUS, an elementary, solid, non-metallic body discovered in 1669 by Brandt, a merchant of Hamburg, who obtained it from urine. It is widely distributed throughout the animal and vegetable kingdoms, but is never found in the free state. Many minerals contain it in the form of phosphate. It was usually made from bone ash, but other calcium phosphates are now also employed. The phosphate is converted into calcium superphosphate by sulphuric acid, and distilled with charcoal and sand in an earthen retort; the phosphorous vapour, which is very inflammable, being condensed in water. When purified it is melted again under water, and moulded into sticks, and these are preserved in water. In this form it is usually met with in commerce. When pure it is almost colourless. The symbol is P, the atomic weight 31, the specific gravity 1.823. It is a non-conductor of electricity. It melts at 44° C. (111° Fahr.) into a viscid oily liquid, which requires great care in handling, being very inflammable, taking fire at once if exposed to air. It can be obtained in octohedric crystals by evaporating the solution in sulphide of carbon. It boils at 250° C. (482° Fahr.) It is insoluble in water, but soluble in ether, benzene, turpentine, and other oils, and specially in sulphide of carbon. The latter solution, when dropped on filter paper and allowed to evaporate, takes fire when dry, on account of the rapid oxidation of the finely-divided phosphorus. If wax be also added to the solution it forms the destructive liquid proposed by Norton to be introduced into shells as a rapid means of setting an enemy's fleet on fire. The solution in olive-oil is used for smearing the face and hands to show luminosity in the dark. This luminosity is one of the characteristics of phosphorus exposed to the air; the fumes have an odour of garlic. Phosphorus should be cut under water, and manipulated with great care, as burns from it are very severe and difficult to heal. Linseed oil and lime water are the best applications. Phosphorus undergoes a singular molecular change when heated in a close vessel for about forty hours to 230° C. (446° Fahr.); it becomes a red powder, having a specific gravity of 2.14, and may be handled in the dry state without danger. It is insoluble in sulphide of carbon, ether, and turpentine. When heated to 260° C. (500° Fahr.) it is reconverted into ordinary phosphorus. Phosphorus is largely manufactured, and principally used in the making of matches, for which both varieties are employed, the red being the safer. The manufacture is difficult, and is almost confined to two firms, one in Birmingham and the other in Lyons, France. Somberite, a calcium phosphate from the island of Sombbrero, West Indies, is now imported as a raw material. Phosphorus is also used as a rat poison. It is a violent poison; French oil of turpentine is considered the best antidote; thirty drops are given every half hour. Workmen in phosphorus factories are subject to necrosis, especially affecting the bones of the jaw, which they sometimes lose altogether. Amorphous or red phosphorus is inert. It is used in medicine dissolved in olive-oil, in doses of one two-hundredth to one-thirtieth of a grain, as a nerve tonic and stimulant; it is useful in neuralgia and some skin diseases.

Phosphorus unites with chlorine, bromine, and iodine with great energy, causing ignition. It forms two

chlorides: the trichloride or phosphorous chloride (PCl_2) and the pentachloride or phosphoric chloride (PCl_5). The trichloride is a colourless liquid of 1.61 specific gravity, and boiling at 78°C . (172°Fahr.) In contact with water it decomposes into phosphorous and hydrochloric acids. When acted on by chlorine it forms the pentachloride. This is a white crystalline substance, which sublimes without undergoing fusion at 100°C . (212°Fahr.) In oxygen it burns with formation of phosphoric acid and liberation of chlorine. It fuses at 148°C . (298°Fahr.) when under pressure.

There are also two bromides of phosphorus: the tribromide or phosphorous bromide (PBr_3) and the pentabromide or phosphoric bromide. The tribromide is a colourless volatile liquid. The pentabromide crystallizes in yellow needles, which may be sublimed unchanged.

There are two iodides of phosphorus, the di-iodide (PI_2) and the tri-iodide or phosphoric iodide (PI_3). The di-iodide crystallizes in orange needles, which fuse at 110°C . (230°Fahr.) The tri-iodide crystallizes in dark red prisms, melting at 55°C . (131°Fahr.) Both iodides are soluble in sulphide of carbon.

There are three anhydrous oxides of phosphorus—the suboxide (P_2O), the trioxide or phosphorous oxide (P_2O_3), and the pentoxide or phosphoric oxide (P_2O_5). The trioxide and pentoxide unite with water, forming phosphorous acid ($\text{P}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$ or $\text{P}_2\text{H}_4\text{O}_5$) and phosphoric acid ($\text{P}_2\text{O}_5 \cdot 3\text{H}_2\text{O}$ or $\text{P}_2\text{H}_6\text{O}_7$). There is also another acid called hypophosphorous acid ($\text{P}_2\text{H}_4\text{O}_4$) which does not exist in the anhydrous state. The suboxide is an orange yellow powder obtained when phosphorus is burnt in air.

Hypophosphorous acid is an uncrystallizable liquid, which is a powerful reducing agent, reducing solutions of salts of silver, gold, and mercury to the metallic state. It forms a great number of soluble crystalline salts known as hypophosphites, and having the general formula MPH_2O_2 ; alkalis decompose these salts into phosphates and hydrogen, and all are powerful reducing agents. The hypophosphites of ammonium, calcium, iron, potassium, and sodium are used in medicine in doses of 1 to 5 grains, in phthisis. A mixture of these salts forms Parrish's "chemical food" for children.

Phosphorus trioxide is a volatile, white deliquescent crystallized substance which dissolves in water with a hissing noise, and forms phosphorous acid; this is also a powerful reducing agent, from its tendency to absorb oxygen and pass into phosphoric acid. It forms two series of crystalline salts known as acid phosphites and neutral phosphites, having the relative general formula MH_2PHO_3 and M_2PHO_3 . These are not decomposed by alkalis. The acid forms three phosphorous ethers.

The pentoxide is obtained by burning phosphorus in dry air; it is a snow-white amorphous body, which sublimes below a red heat. It is very deliquescent and has a great affinity for water, with which it combines with great development of heat, and forms three different phosphoric acids—monohydric or metaphosphoric acid ($\text{H}_2\text{O} \cdot \text{P}_2\text{O}_5$), dihydric or pyrophosphoric acid ($2\text{H}_2\text{O} \cdot \text{P}_2\text{O}_5$), trihydric or orthophosphoric acid ($3\text{H}_2\text{O} \cdot \text{P}_2\text{O}_5$).

Metaphosphoric acid is a clear glass; it forms salts called metaphosphates, having the general formula $\text{MP}^\circ\text{O}_3$. The solution precipitates albumen.

Pyrophosphoric acid forms indistinct white crystals. The solution does not precipitate albumen, but gives a white precipitate with salts of silver. It forms four classes of salts called metaphosphates, and containing from one to four atoms of the base.

Orthophosphoric acid is the most common and most important. It may be obtained in prismatic crystals; it does not precipitate albumen nor salts of silver. It forms three classes of salts called orthophosphates, containing one to three atoms of the base. The orthophos-

phates give a yellow precipitate with nitrate of silver. Many orthophosphates are found in minerals; the turquoise is an orthophosphate of aluminum; apatite is orthophosphate of calcium; redonda phosphate is orthophosphate of aluminum. Tricalcic phosphate ($3\text{CaO} \cdot \text{P}_2\text{O}_5$) is the important manure found in bone ash, coprolites, &c. For manurial purposes this is usually rendered soluble by sulphuric acid. Triferrous phosphate ($3\text{FeO} \cdot \text{P}_2\text{O}_5$) is found native as vivianite.

There are a number of phosphates of copper known as minerals, such as libethenite, pagilite, and dihydrite.

Trinagesic phosphate ($3\text{MgO} \cdot \text{P}_2\text{O}_5$) is also found native in Haguerite. It is a common constituent of plants, and of some animal concretions. The ammonio-magnesian phosphate, $(\text{NH}_4)_2\text{MgH}_2\text{P}_2\text{O}_5 \cdot 3\text{H}_2\text{O}$, is a very insoluble crystalline salt, separating from dilute solutions, and forming a delicate test for magnesia and phosphoric acid. It is present in urine, and forms the so-called fusible calculus. The phosphates of molybdenum and uranium are insoluble precipitates, and the solutions of these metals also form delicate tests for phosphoric acid.

The orthophosphate of soda, or disodic orthophosphate (Na_2HPO_4 or $\text{Na}_2\text{O} \cdot \text{P}_2\text{O}_5 \cdot \text{H}_2\text{O}$), is the ordinary phosphate of soda of commerce. It is found in the blood and urine, and is used in medicine as a tasteless purgative.

Phosphoric ether, $(\text{C}_2\text{H}_5)_2\text{H}_2\text{P}_2\text{O}_5$, or ethylphosphoric acid, is a viscid oil soluble in water, alcohol, and ether. Sodio-ammonia orthophosphate, $\text{Na}(\text{NH}_4)\text{H}_2\text{P}_2\text{O}_5 \cdot \text{H}_2\text{O}$, is a crystalline salt known as microcosmic salt, and employed in fluxing minerals before the blowpipe. The salt when heated gives off its water and ammonia, and fuses into a clear glass, which dissolves metallic oxides, producing beads having characteristic colours.

There are three phosphides of hydrogen—phosphoretted hydrogen or phosphamine (PH_3), liquid phosphide of hydrogen (PH_2), and solid phosphide of hydrogen (P_2H). Phosphamine is a gas often produced by decaying animal bodies, especially fish. When pure it is a colourless gas, having a specific gravity of 1.214, which liquefies at a low temperature, and has the odour of the stinking fish which evolve it. It is usually contaminated with the liquid phosphide, which renders it spontaneously inflammable. This is a colourless liquid, burning in the air with an intense bright flame. The action of light resolves it into phosphamine, and the solid phosphide, which is a yellow solid insoluble in water and alcohol.

Six compounds of phosphorus with sulphur are known—the subsulphide (P_4S), a colourless liquid; the protosulphide (P_4S_2), a dense yellow liquid of repulsive odour; the sesquisulphide (P_4S_3), crystallizing in yellow prisms; the trisulphide (P_4S_4), a pale yellow substance, melting at 200°C . (392°Fahr.); the pentasulphide (P_4S_5), a pale yellow crystal; and the persulphide (P_4S_6), obtained in yellow shining crystals.

There are a large number of organic phosphorous bases, known as ethyl and methyl phosphines and phosphammoniums. These bodies are phosphamine, in which the hydrogen is more or less replaced by ethyl or methyl, such as triethylphosphine, $(\text{C}_2\text{H}_5)_3\text{P}$, and trimethylphosphine, $(\text{CH}_3)_3\text{P}$. The former is a colourless liquid of specific gravity 0.812, and boiling at 127°C . (260°Fahr.), of penetrating odour, producing headache. The latter is a denser liquid, boiling at 40°C . (104°Fahr.), and having a most disagreeable sickly odour. From these bodies an extensive series of phosphammonium salts are derived.

Phosphorus is detected when in minute quantity by converting it into phosphoric acid, by oxidizing it with nitric acid. The phosphoric acid is usually estimated as ammonio-magnesium phosphate.

PHOTINIANS, in ecclesiastical history, a sect of heretics, in the fourth century, who denied the divinity of Christ. They derive their name from Photinos.

PHOTINOS, Bishop of Sirmium during the first half of the fourth century, was probably a native of Ancyra in Galatia. In the year 313 he broached strange opinions, affirming that the Holy Spirit is not a person, but only a divine attribute; maintaining the mere humanity of Christ, or that he only began to be when he was born of the Virgin by the Holy Ghost, and that the word or *logos* is neither substance nor person, but simply the divine understanding. He was condemned by a semi-Arian council at Antioch in 345, by an orthodox council at Milan in 347, and by an Arian council at Sirmium in 351. Photinos was deposed, and died in exile in 372.

PHŌTIOS (Lat. *Photius*), the famous opponent of Ignatius in the contest for the patriarchate of Constantinople in the ninth century, was a layman in high office in the state at the time he was chosen for elevation to the patriarchal see on the deposition of Ignatius; this was in the reign of the young Emperor Michael III., December, 857. The Pope (Nicholas I.) warmly took up the cause of Ignatius; and this was the beginning of the great schism between the churches of the East and the West. Nicholas sent letter after letter denouncing and threatening the usurper, as he deemed him; and held more than one council of the church to judge the cause, always with the foregone conclusion of the condemnation of Phōtios. At last the patience of the latter, who had maintained a dignified and even conciliatory attitude throughout, gave way, and he drew up six formal accusations of heretical practices sanctioned at Rome, among which the last was the perversion of the creed by the insertion of the words *filioque* ("and from the son") as to the procession of the Holy Ghost, words not to be found in the ancient versions. Mixed with this very grave charge are others of comparatively trifling import, such as the shaving of the chin at Rome, whereas the older church took pride in long beards, the restriction of christ to the bishops, &c. What underlay the whole, though it was not stated, was a firm determination to oppose the papal supremacy over the Greek Church, now repeatedly put forward. The Emperor Basil, when he succeeded Michael, whom he had murdered, gave way to Rome and exchanged Ignatius for Phōtios (867); but when Ignatius died ten years later, Phōtios was restored, having gained the confidence and favour of the emperor, and even the goodwill of the Pope (John VIII.). On the succession of Leo VI., Phōtios was out of favour once more and was banished to Armenia, where he remained in a monastery till his death in 891.

Besides the very important part which Phōtios played in the religious world, we owe a great debt to him for having preserved to us, in a careful analysis of nearly 300 works extant in his time, the essential particulars of many famous writings now utterly lost (*Novi Bibliotheca*, or "The Library," the best edition by Bekker, Berlin, 1825). He was a man of great culture and the widest reading of the time, and his judgment is therefore of value. Fragments of other works exist, among which is a glossary or lexicon (edited by Porson, Cambridge, 1822).

PHOTIUS. See PHOTIUS.

PHOTOGRAPHY. The art which is distinguished by the generic term Photography (Gr. *phōs*, light, and *graphō*, I delineate) includes many distinct processes of sun-drawing. The primary results are in all cases images of objects produced by the action of the sun's rays on surfaces sensitive to the chemical action of light, although many recent processes for the multiplication of pictures so obtained are more or less mechanical.

In the sixteenth century Baptista Porta, a Neapolitan, invented the *camera obscura*, a chamber or box to the interior of which light is admitted through a convex lens, and the rays received on a screen, on which inverted images of the external objects which reflect the light are depicted. This instrument was subsequently made use of to a con-

siderable extent as an aid to drawing, or rather tracing, on a semi-transparent paper the images which it formed; but centuries had to elapse before the idea took shape of making the rays of light themselves perform this work.

In 1777 the illustrious chemist, Scheele, discovered the primary fact upon which the majority of photographic processes rest, namely, that a salt of silver, the chloride, was blackened by the sun's light, the chief action being in the violet ray. A century earlier mention is made by the alchemists of the fact that *luna cornua* (chloride of silver) is acted upon by light, a circumstance regarded as significant in connection with their theories of the transmutation of metals. It is not, however, until 1802 that any record is found of an attempt to utilize this fact in the production of transcripts of objects. In that year Thomas Wedgwood, the son of the celebrated potter, published in the *Journal of the Royal Institution*, "An account of a method of copying paintings on glass, and of making profiles by the agency of light upon nitrate of silver," describing a series of experiments in which he had been assisted by Sir Humphrey Davy. They succeeded in producing pictures on paper and white leather, rendered sensitive to light by treatment with nitrate of silver; but they failed in finding a means of fixing them, the whole surface gradually blackening under the action of light, and the images first produced being thus obliterated. By this process images of objects were obtained in the solar microscope, but those of the *camera obscura* were too faint to give an impression.

In 1814 Joseph Nicéphore de Niépce, a French ex-officer of infantry, commenced a series of experiments for the purpose of producing camera pictures by the action of light, his immediate object being to improve on the recently invented art of lithography by avoiding the necessity of drawing on the stone. In this he failed, but he finally succeeded in producing pictures in the camera by employing a coating of asphaltum upon a surface of metal. This bituminous film was rendered insoluble by the action of light, and was then partly removed by a solvent. Thus he finally succeeded in producing permanent pictures; but the time of exposure required was too great (amounting to several hours) to permit of the process being practically successful for photography from nature. Niépce subsequently entered into a partnership with a painter called Daguerre to continue the search for a more perfect photographic process, but it was not until 1839, six years after the death of Nicéphore de Niépce, that Daguerre communicated, through Arago, to the Académie des Sciences at Paris, the process which was henceforth known as *Daguerreotype*, and for which a pension was awarded by the government to him and also to Isidore Niépce, the son of Nicéphore.

The new process consisted in the use of silver or silver-plated tablets, on which was formed, by the action of iodine vapour in the dark, a surface of iodide of silver. The iodized silver tablet having been submitted for a few minutes to the action of light in the camera, presented no visible change; nevertheless a latent image was there impressed, which was brought into visible being in virtue of a new affinity which the action of light had produced. On exposing the tablet to the vapours of slightly heated mercury, a deposit of this metal took place in all the parts where light had impinged, the greatest amount being deposited where light had acted with the most energy, and less in the parts more imperfectly illuminated, thus giving an image which represented the original object in every gradation of light and shade. The unchanged iodide of silver was then dissolved and removed by a solution of hyposulphite of soda, and the picture thus fixed. M. Claudet and Mr. Goddard, by the introduction of chlorine and bromine into the process, assisted in giving sensitiveness to the plates and beauty to the results; and M. Fizeau, by the applica-

tion of a film of gold deposited on the shadows from a solution of gold chloride mixed with the fixing solution, gave fresh beauty and stability to the pictures.

On the 25th January, 1839, just before the publication of Daguerre's process, Mr. H. Fox Talbot communicated to the Royal Society of London, a paper on "Photogenic Drawing," describing a method of producing pictures on paper prepared with chloride of silver. A strong solution of chloride of sodium, or of bromide of potassium, effected the *fixing* of the picture, which Wedgwood and Davy had failed to secure. The use of hyposulphite of soda for fixing, the solvent action of which upon salts of silver had been published by Sir John Herschel in 1821, soon superseded all other methods; and it is now almost exclusively used for fixing purposes in all processes in which the salts of silver are employed.

The *Calotype* or *Talbotype* process, a further discovery by Mr. Fox Talbot, was patented in 1841. By this method the prepared paper was sufficiently sensitive to receive the images of the *camera obscura* in an exposure of a few minutes. Fine writing paper was brushed over with a 20 per cent. solution of nitrate of silver dissolved in distilled water. When dry it was immersed for a few minutes in a solution containing 5 per cent. of iodide of potassium, then rinsed and left to dry. When required for use, it was brushed over with a solution of gallo-nitrate of silver, prepared by mixing in equal volumes a 10 per cent. solution of nitrate of silver, containing a little acetic acid, and a saturated solution of gallic acid. The paper after rinsing and drying was ready for the camera, where a short exposure produced, as in the Daguerreotype process, a latent image, which was developed by a further application of the gallo-nitrate of silver solution. After washing and fixing, the process was complete.

The great advance made in this process on paper consisted in the employment of a *developing agent*, gallic acid, to render visible the image impressed by light in the camera, and it seems certain that the Rev. J. B. Reade is entitled to the credit of having been the first to make this discovery (as early as 1839). Fox Talbot's process was, however, an improvement inasmuch as he employed a *restrainer*, acetic acid, to check the too rapid reduction of the silver by the developer.

The photograph produced by this process is called a *negative*, by which is meant an image in which the lights and shades are reversed. The portions represented by white in the original are represented by black in the negative, while the black portions are represented by white; and so in the various gradations. From the negative it is possible to print thousands of positives, in which the lights and shades are in their true pictorial relations, by the *printing processes* to be subsequently described. In this respect the process was a great advance on the Daguerreotype, though not at first so delicate in detail.

The next step consisted in the substitution of a plate of glass for the paper negative, which was effected by M. Niépce de St. Victor, a cousin of Nicéphore Niépce, in 1848. He coated the glass plates with albumen containing a soluble iodide, and the plate was subsequently sensitized by immersion in a solution of nitrate of silver, iodide of silver being formed in the film, which was exposed and developed in much the same way as in Fox Talbot's paper process. This method had the advantage that the plates could be washed and dried after sensitizing and exposed in a dry state, thus anticipating subsequent dry-plate processes. The negatives were found decidedly superior in delicacy to those produced on paper, and better adapted for printing; but the plates unfortunately proved very insensitive. Various other substances, such as gelatin, starch, &c., were tried as vehicles to hold the sensitive silver salts on the surface of the glass, but with small success, until the discovery of the *collodion process*.

Collodion is a solution of pyroxilin (a species of gun-cotton) in a mixture of alcohol and ether. Its use in photography was proposed by Le Gray of Paris, in January, 1851, but he gave no account of his process. In February of the same year Mr. Scott Archer, of London, published in the *Chemist* a very complete description of the collodion process practically as it has remained ever since.

The collodion employed is formed by dissolving pyroxilin—about one per cent. is commonly used—in a mixture of sulphuric ether and alcohol; a coating of this preparation applied to a plate of glass forms a transparent film. To render it useful in photography, about one per cent. of a mixture of iodides and bromides is dissolved in the collodion. Different iodides and bromides may be employed, those of cadmium and ammonium being commonly used. A perfectly clean plate of glass is coated with the prepared collodion, and plunged into a 6 or 7 per cent. solution of nitrate of silver, where, by a process of double decomposition, iodide and bromide of silver are formed in the film, producing a surface which is extremely sensitive to the chemical influence of light. This film is then submitted to the action of the luminous image in the camera, a few seconds sufficing to impress the latent image, which on the prepared calotype paper required a few minutes. The image is made visible, as in the Daguerreotype and calotype processes, by development, which in this case is effected by a solution of some reducing or de-oxidizing agent; pyrogallie acid or sulphate of iron being generally employed, the latter in the great majority of cases. The effect of either of these developers is to precipitate metallic silver from the free silver nitrate in the film, and this precipitate attaches itself to those portions of the film previously acted on by light. Those portions of the objects photographed which reflected the most light are represented in the photographic image by the densest deposit of reduced silver, and every other portion by a deposit corresponding with the amount of light reflected.

The developer generally used consists of a solution of ferrous sulphate, varying in strength according to circumstances from 1 to 10 per cent., rendered acid by the addition of acetic or other acid. In some cases the amount of the deposit is increased, either by modifications of the developing solution, or by the continued application of a reducing agent and a solution of silver nitrate, the process being termed *intensification*. When the required deposit of silver is obtained, the image is fixed by removing, with solution of hyposulphite of soda or cyanide of potassium, all salts of silver which remain in the film after the formation of the image. It is necessary to observe that all those operations, except the last, must be performed in a room from which the most chemically active rays of light are carefully excluded, which is commonly effected by the use of a window of yellow glass, silver iodide being peculiarly insensitive to the yellow rays.

A very important peculiarity of the collodion process is, that the exposure must be made while the film is wet from the sensitizing bath. If allowed to dry, the salts contained in it crystallize and destroy the film. This, though of little consequence in the photographic studio, was found to be a most serious disadvantage to the landscape photographer, who was forced to carry about with him a portable "dark room" in the form of a tent, which added so greatly to the labour of outdoor photography that persistent efforts were made to get rid of it. At first solutions of various deliquescent salts were applied to the film, to prevent its drying rapidly. It was next discovered that by the addition of various organic substances to the film, it could be induced to retain its sensitiveness even after having been washed (to remove the soluble salts) and dried. The most reliable of these processes was probably that of Taupenot, who after coating a plate with collodion

and sensitizing it in the usual way, washed it and then covered it with a film of albumen; and after it had dried, again sensitized it in a silver bath acidified with acetic acid, and then washed and dried it once more. The process was tedious, and the plates not very sensitive, but they produced excellent results when time of exposure was of little consequence. It was necessary, however, to add a little silver nitrate to the developer, this not being present in the film as in the wet process; and it was soon discovered that the plates were greatly improved by the addition of a considerable amount of a soluble bromide to the collodion, thus forming silver bromide in the film.

It was next discovered that films containing silver bromide could be developed by means of a solution of pyrogallie acid, with the addition of an *alkali* instead of an acid as hitherto, and without any free silver nitrate being present. This important improvement, introduced by Major Russell in 1862, greatly increased the sensitiveness of dry plates, while a restrainer, in the form of a soluble bromide afterwards added, rendered this developer still more reliable, and laid the foundation of the most modern procedure.

In 1864 Messrs. Sayce & Bolton described in the *Photographic News* a process by which the use of the silver bath was entirely dispensed with. This object was attained by adding an alcoholic solution of silver nitrate, with agitation, to a collodion containing a soluble bromide only. The resulting substance, called an *emulsion*, could be poured like collodion on a glass plate, which was then washed to remove the soluble salts (produced by double decomposition) and allowed to dry, when it could be used with or without the addition of an organic substance as a preservative.

In 1874 it was discovered that this washing of the plates could be obviated by evaporating the solvents of the collodion, washing the residue thoroughly, drying and redissolving it in fresh solvents. The emulsion had then simply to be applied to the glass plate, which was at once ready for use.

Meantime, in September, 1871, Dr. R. L. Maddox published his first notice of the preparation of an emulsion of silver bromide in *gelatin*, and produced a number of negatives taken by this new process, which was destined to effect a revolution in photography. But it was not until March, 1878, that the latent capabilities of the process were fully shown by Mr. Charles Bennett, who discovered that by digesting the emulsion for several days at a temperature of 32° C., its sensitiveness could be made to exceed that of the most rapid wet plates ever produced. Henceforth its use rapidly extended throughout the world, not only for outdoor work, but even in the studio, where its rapidity greatly increased the facilities for producing artistic portraits. Other methods of increasing the rapidity of the emulsion of silver bromide in gelatin were subsequently discovered, one being its exposure to the temperature of boiling water for about thirty minutes, and another its digestion with ammonia. The following may be given as a typical process, though there are numerous formulæ in use:—

Eight parts of potassium bromide are dissolved in 100 parts of water, and from 10 to 15 parts of gelatin introduced. After soaking some time the whole is dissolved by immersion of the containing vessel in a water-bath, at a temperature of 65° C. Ten parts of silver nitrate, previously dissolved in 100 parts of water, and raised to the same temperature, are now gradually introduced with constant agitation. The mixture is rendered very slightly acid by means of a weak solution of hydrochloric or hydrobromic acid, and exposed for about thirty minutes to a temperature of 100° C. in a water-bath, the whole being, of course, carefully shielded from light, except what may be transmitted from a lamp or a gas-flame through the deepest ruby glass. The emulsion is then allowed to cool until it forms a jelly,

broken up into shreds, and washed for some hours in running water to remove all soluble salts. It is then drained clear of superfluous water, melted, filtered, and used for coating the plates, which must be placed to "set" on a perfectly level shelf and then dried in total darkness. They are then ready for use in the camera. It is not unusual to introduce at first only a part of the gelatin (say one-seventh), and to add the remainder after the digestion at 100° C. This is believed to hasten the production of the most sensitive variety of silver bromide, and also to diminish the risk of decomposition of the gelatin.

Another method of attaining sensitiveness consists in mixing with the silver nitrate solution before its addition to the bromized gelatin, just sufficient ammonia to redissolve

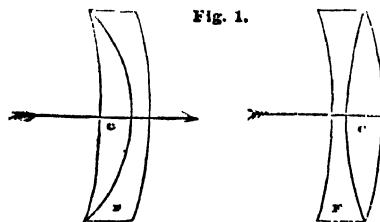
ture of 32° C., may also be followed.

Some idea of the extreme sensitiveness of films produced by this process may be obtained from the statement that photographs of rapidly moving objects have been taken in $\frac{1}{400}$ of a second. The time of exposure of the Daguerreotype was originally about half an hour.

One result of the convenience and portability of the gelatin plates has been to direct attention once more to paper as a support for the sensitive compound when intended for use out of doors. The paper may be wrapped on a suitable roller in a continuous ribbon long enough for twenty or more exposures, and very ingenious appliances for holding and exposing such rolls of sensitive paper have been introduced both in this country and the United States. Paper negatives, however, as in the original calotype process, require subsequent treatment with wax, castor-oil, or some other substance to render them sufficiently transparent for printing.

These films and the gelatin dry plates are generally developed in England with the alkaline pyrogallie developer, already described, but various other substances have been found capable of developing silver bromide. The most generally used of these is a solution of ferrous oxalate in neutral potassic oxalate, readily prepared by adding one part of a saturated solution of ferrous sulphate to three parts of saturated solution of potassic oxalate. A small quantity of a soluble bromide is generally used as a restrainer.

The *optical apparatus* used in photography consists of the *camera* and the *lens*. The former is essentially a box having an aperture in front to receive the lens, and a groove by means of which the cell containing the sensitive surface can be fitted light-tight into the back. A movable screen of ground glass takes the place of this cell when the image is being focussed. To facilitate this operation the box is constructed in two halves sliding on each other like



the tubes of a telescope, or, if intended for outdoor use, its sides are formed of leather, so that it opens out like an accordion.

The lens generally used for landscape work is of the form shown in section in fig. 1. To render it achromatic it is formed of two lenses, one of crown glass, c, and one

of flint glass, &c, cemented together. This lens is mounted with the concave side outwards, and a diaphragm in front to cut off superfluous light. When it is important that no distortion of the image should take place two such lenses are mounted at opposite ends of a tube, their concave sides facing each other, and with diaphragm between. The distortion produced by one is corrected by that of the other.

Fig. 2.

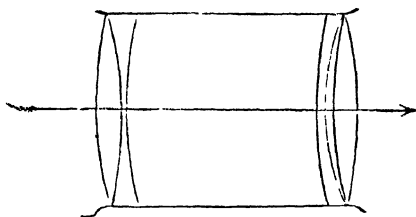


Fig. 2 represents the form of lens used for taking portraits. Its chief merit is the transmission of a large pencil of light, and consequent rapidity of action.

Photographic Printing Processes.—In all the processes hitherto described, except the Daguerreotype, the picture produced by means of the camera has its lights and shades reversed, and is called a *negative*. The production from this negative of another photograph having the lights and shades as in nature, is termed *printing*. For this purpose several processes are in use, some of them purely photographic, and others partly mechanical.

The process still in most general use, under the name of *silver printing*, is practically the same as that introduced by Fox Talbot in 1839, and subsequently improved by him by adding a varnish of albumen to retain the sensitive salts on the surface of the paper, thus increasing the brilliancy of the print.

Fine white paper, expressly prepared for photography, and chiefly of French or German manufacture, is coated with a varnish of egg albumen, to which has been added from 1 to 2 per cent. of ammonium chloride or other soluble chloride. In this state it can be kept ready for use. To prepare it for printing it is floated, with its prepared side in contact, on a 10 per cent. solution of silver nitrate, a surface of chloride of silver embedded in an insoluble coating of albuminate of silver being thus formed. This surface is sensitive to light, and on being exposed under a negative darkens wherever light reaches its surface, producing a positive print on albumenized paper. In order to give increased permanency and richness of colour to the picture thus obtained, it is customary to submit it to the action of a *toning bath*, consisting of a solution of chloride of gold; a film of metallic gold in a fine state of subdivision, giving a purple tint, being precipitated on the dark parts of the image, by what is termed a process of substitution. After toning, the print is submitted to a bath containing 20 per cent. of hyposulphite of soda, by which all chloride of silver which has not been reduced by light is dissolved and removed from the paper. By this process the picture is *fixed*. After washing for some hours in repeated changes of water to remove all traces of the fixing solution, the picture is dried and is then ready for mounting.

Chloride of silver has also been emulsified in collodion and successfully employed on paper and other supports, by a process introduced by G. W. Simpson. The most important advance, however, that has been recently made in purely photographic printing has been the application to this purpose of paper coated with a gelatin emulsion, so sensitive that a few minutes' exposure under a negative to artificial light is sufficient. This exposure, however, has to be followed by development, as in the case of negatives.

after which the prints are toned and fixed very much like prints on albumenized paper, but are dried with their faces in contact with a glass plate to give finish to the surface.

Besides those silver salts, several salts of iron and of uranium are also sensitive to light. Upon the former depends Sir J. Herschel's *cyanotype* process, in which paper sensitized with the double citrate of iron and ammonium is developed, after exposure, with a solution of potassium ferrieyanide, giving a blue positive if exposed under a negative.

A positive print can be obtained after exposure under a positive (such as a drawing on translucent paper) by sensitizing with a solution of about 10 per cent. ferric chloride and 5 per cent. oxalic acid, and, after exposure, developing by floating on a solution of potassium ferrieyanide.

The *platinotype* process, invented by Mr. Willis, depends on the sensitiveness of ferric oxalate to light, which reduces it to ferrous oxalate. The latter salt has the power, when dissolved in potassic oxalate, of reducing platinum from the chloride. The sensitive surface is prepared with a solution of ferric oxalate and potassic platinous chloride, and after exposure is developed by floating on a hot solution of potassic oxalate, which reduces the platinum as a black deposit wherever the light has acted, giving a print of great permanence on ordinary unglazed paper, somewhat resembling a charcoal drawing.

Paper sensitized with a solution of nitrate of uranium and developed with potassium ferrieyanide yields prints of a brown colour. It may also be developed with a solution of nitrate of silver or of chloride of gold.

Carbon Printing or Autotype Process.—A different class of printing processes is that which depends upon the power of light to render insoluble gelatin which contains an alkaline bichromate. In the year 1839 Mungo Ponton of Edinburgh discovered that paper prepared with potassium bichromate was sensitive to light. In 1855 M. Poitevin patented a process for printing in carbon by means of a film of gelatin sensitized with potassium bichromate, and coloured with a carbon pigment; but it was not until 1864 that J. W. Swan rendered the process practically valuable. The film used in his process consists of gelatin coloured with some suitable pigment, the more permanent the better, and sensitized by floating on a 5 per cent. solution of potassium bichromate. It is then dried in the dark, and when dry exposed to light under a negative. The print then requires to be developed. It is soaked in cold water until it becomes flat, and then attached by pressure, face downwards, to a finely milled zinc plate, or in the most recent process to a flexible support of water-proofed paper. To secure adhesion, a mixture of resin and beeswax is applied to the face of the support. The print is now immersed in water at a temperature of about 38° C. The paper on the back can soon be peeled off, and by careful sponging of the back of the film the soluble portions of the gelatin are entirely removed, leaving only those acted on by light adhering to the support. The print thus exposed is of course reversed as regards right and left, though not as regards light and shade. To correct this it is brought into contact with paper coated with insoluble gelatin which has been softened in hot water. To this the carbon print adheres, and when dry can be readily stripped from its temporary support, and is then in appearance very much like an ordinary silver print, but much more durable.

Woodburytype or Photo-relief Printing.—About the same time a very different printing process, though one depending on the same principles, was invented by Mr. W. Woodbury. In it a sensitized gelatin film of great thickness is exposed under a negative, and developed as in the autotype process, to remove all the gelatin unacted upon by light. The film is then dried in contact with a glass or metal plate, and now forms a *matrix*, in which the

highest lights of the picture are represented by the thinnest portions of the film, and the deepest shadows by the thickest, all intermediate tints being represented by proportionate thicknesses. A mould is taken from this matrix by forcing it under hydraulic pressure into a plate of soft metal. It is obvious that by means of the mould a *cast* can be produced in all respects resembling the original film. For this purpose a warm solution of gelatin coloured with any suitable pigment is employed. This is run into the mould, a piece of perfectly flat and even paper placed upon it, and pressure applied to squeeze out all superfluous gelatin. As soon as the gelatinous ink has "set" the paper can be removed, bearing on its surface a picture in gelatin, the lights being almost bare paper, while the shadows are coloured with the pigment employed. It is evident that when the mould is once made printing can proceed quite independently of light, the latter part of the process being mechanical. For this reason the process has been very extensively employed, especially on the Continent. Shortly before his death Mr. Woodbury still further simplified the method of producing the mould by making a gelatin matrix by exposure under a glass *positive*, and covering this matrix with a smooth sheet of tinfoil. It thus becomes itself a mould from which copies may be printed, as from the metal mould last described. This modification of the process is known as *stano-type*.

Collotype.—A third printing process, founded on the effects of light on bichromated gelatin, is that known as *collotype* or *heliotype*. It depends on the fact that such a film, after exposure under a negative, will absorb cold water in the proportions in which it has been shielded from the light. If now it is rolled up like a lithographic stone, with a roller charged with greasy ink, it is found that the ink adheres to the driest portions of the film, which represent the shadows of the picture, and by using two inks of different degrees of stiffness, the softer of which adheres best to the half tones, a greater range of tone is obtained. It is found convenient to use a glass plate as the support of the gelatin film, because its transparency enables the film to be sunned from the back and thereby rendered insoluble at that side, which greatly increases its durability. This process, though not producing results equal to the last, is extensively used from its cheapness. It has even been found possible to print from such films by steam power. Sometimes the gelatin "skins" are separated from their glass support and cemented to one of metal. On the Continent it has been found that the best results are produced by rollers covered with velvet.

Photolithography, the process of transferring to a lithographic stone a photograph of any subject in black and white, was the object of Niépce's first attempt at photography. He then failed, but a successful process was published by Dixon in America, as early as 1851. The process most generally used was, however, first introduced at the Ordnance Survey Office at Southampton in 1860, by Sir Henry James, and was used for transferring to zinc as well as to stone. It consists in coating bank-post paper with a mixture of gelatin 3 parts, potassium bichromate 2 parts, and water 50 parts, after which it is dried in the dark. It is then exposed to light under a negative, which must be intensified until perfectly opaque in all parts except the lines forming the image, and when a strong impression has been obtained the print is evenly coated all over with a greasy transfer ink by passing it through a press in contact with an ink-covered stone. It is then floated, face upwards, in warm water until the gelatin swells where the light has not acted, and the softened gelatin is removed by careful sponging, carrying with it, of course, its coating of ink. But the lines of the image, being insoluble, remain, and there is thus left a photograph, in greasy ink, of the original drawing. The print is next dried and subsequently transferred to a lithographic stone

or prepared zinc plate in the same way as an ordinary drawing in transfer ink.

Another process, introduced by Abney, consists in wetting or damping the print before inking it. On then rolling it up with a roller (of a gelatinous composition) charged with greasy ink, the latter adheres only to the lines of the drawing, as in the collotype process. A *transfer* is thus obtained which is dried, again exposed to light so as to harden the whole of the gelatin, and finally damped and transferred to stone, as in the first process. While these processes have been very successful in transferring enlarged or reduced copies of maps or drawings, they are not equally suitable for reproducing photographs from nature, as the half tones are not well rendered.

Photographic Engraving Processes.—Nicéphore Niépce, the originator of photography, was also the first to apply it to the production of plates that could be printed from at the ordinary copperplate press. His process, though unsuccessful in reproducing subjects in half tone, such as views taken from nature, was quite efficient in dealing with pictures in black and white, such as engravings and pen-and-ink drawings, and for this purpose is still practised with some modifications. A copper plate is coated with a solution of asphaltum in benzole or in turpentine, and dried, of course, in the dark. It is then exposed to light under a transparent positive of the subject to be copied, and finally developed by careful washing with olive oil and turpentine, which soften and remove the coating from those parts that have been protected from the action of light. The plate is then etched with acid in the ordinary way, and is ready for printing.

In 1852 and 1858 Fox Talbot patented processes based on the action of light on bichromated gelatin, intended to reproduce subjects in half tone. A copper plate was coated with fine particles of resin to give it a "grain," as in the process of aquatint engraving. A print on bichromated gelatin (taken under a positive or transparency) was attached to its surface, and the plate then etched through the gelatin with solutions of ferric chloride of different strengths, the weakest being able to penetrate the coating most easily.

One of the most recent processes, that of Obernetter of Munich, very ingeniously applies the gelatino-bromide process in the following manner. The metallic silver image of a gelatin negative is converted by chemical means into chloride of silver. The entire film is then stripped from the glass and applied to the surface of a copper plate. Under the influence of a voltaic current the silver chloride is decomposed, the chlorine uniting with the copper and etching it to a greater or less depth according to the thickness of the deposit of chloride. The result is a grained intaglio plate of great delicacy. The action of light on bichromated gelatin has been also utilized in another manner. As explained in the description of the collotype process, such a film, after exposure to light, only absorbs water in those portions which have not been acted upon. By the use of a thick film sufficient relief has been obtained to enable a cast to be taken from the swelled gelatin; and an electrotype taken from this cast furnishes a printing block. If the subject to be reproduced is not in line, but in half tone, as a photograph from nature or a wash drawing, means have to be adopted to produce a *grain* in the gelatin relief, and several methods have been adopted for this purpose, but these have generally been kept secret. Blocks thus produced may be in *intaglio*, in which case they are worked at the copperplate press, or in *relief*, when they are adapted for typographic or letterpress printing, like woodcuts. The employment of the latter class of blocks has greatly increased of late, and in the reproduction of subjects in line great perfection has been attained. As early as 1854 a patent was taken out in England, by Paul Pretsch of Vienna, for producing such blocks from a film of bichromated gelatin,

The process as worked by him was not successful, but was rendered practicable by the inventions and improvements of Mr. D. C. Dallas of London. In 1862 Mr. Dallas introduced a process for the production of plates for copperplate printing from photographs, and in 1865 and 1875 processes for the production of line and grained blocks for letterpress printing, which were, we believe, the earliest commercially successful processes of this description.

Another class of processes is based upon photozincography. Any image in fatty ink upon paper produced in the manner already described may be transferred to zinc, and used as a resist to an etching fluid which dissolves away the unprotected parts, thus leaving the image in relief. For the reproduction of subjects in black and white, it is only necessary to prevent the lines from being underbitten, which may be done by frequently rolling them up with fresh ink, and sprinkling them with resin powder, which adheres to the ink. The loose powder being removed, the block is heated and the resin melts, running down the sides of the lines, and thus protecting them from corrosion.

But when it is desired to reproduce a subject in half tone, it is necessary to translate the continuous gradation of a photograph into the broken gradation of a letterpress block. This has been attempted by different methods. In that of F. E. Ives of Philadelphia, United States, a Woodbury relief is inked, and transfer paper, the surface of which has previously been covered with a fine grain or stippling, is pressed in contact with it. The deep shadows of the picture being most elevated, are pressed with sufficient force to fill up with ink the spaces between the dots and produce solid blacks, the half tints being represented by a regular gradation in the size of the dots. This impression may then be transferred to zinc, and etched as above described.

Another method consists in printing through screens, produced by photographing a network of lines down to any required scale. These lines break up the half tones of the transfer into a minute chequer, as shown in Plate III. The printing block is produced as before by transferring to zinc and etching.

In Plate I. we are able to give our readers an example of a photograph from nature engraved by the process of Klie, by Messrs. Amann, and printed at the copperplate press. Plate II. is an example of a block for letterpress printing, produced from a photograph by the process of Mr. D. C. Dallas, and Plate III. is a similar reproduction of a *wash drawing* by the *Meisenbach* process.

PHOTOMETER (*Gr. phôs, phôtos, light*), an appliance for measuring the intensity of light. A simple form is Lambert's photometer (1760), which is simply a stick placed a short distance behind a screen of semitransparent paper. The shadows of the stick, thrown from two separate light-sources upon the screen, are adjusted to the same intensity by moving the sources of light to and fro, and their relative distance from the screen when this result has been obtained gives the measure of the intensity of their light, which varies according to the square of the distance. If an opaque screen, pierced with a circular hole, be used instead of the stick, the lights themselves may be directly compared instead of the shadows produced by the lights.

There are several other sorts of photometer, their principal function being at present to measure the illuminating power of the coal-gas used for lighting, and the best of these, Bunsen's photometer, is fully described in GAS PHOTOMETRY.

PHOTOSPHERE is the name given to the bright surface of the stars, including our own sun. What condition the body of a star may be in we have no means of telling, but of the surface by which we know it, namely, the photosphere (*Gr. phôs, phôtos, light*), we know by the spectroscopic that it is at an intense heat, so that it is either

liquid or vaporous, and also that it is surrounded by an atmosphere of vapours in the same way as the earth is surrounded by the air.

PHRAGMITES is a genus of GRASSES having the spikelets, which contain from three to six flowers, in large spreading panicles. *Phragmites communis* (the reed) is the largest British grass, occurring on the edges of lakes and other places where water abounds. It has a tall, stout stem, with an extensively creeping root-stock and a dull purple inflorescence. It is of no importance agriculturally, but is useful for binding the earth on the banks of rivers with its creeping root-stocks. It occurs in Northern Europe, and is common in Siberia, Japan, North America, and even Australia, forming thick coverts, and yielding an abundance of stout durable grass of great value for the purpose of thatching the roofs of buildings.

PHRAH or **PEIRA**, the name translated Pharaoh in the Scriptures, and meaning really son of Ra (*Pi-Ia*), that is, son of the Sun, Ra being the name of the divinity of the sun in ancient Egypt. (Phrah is often used as synonymous with Ra, but incorrectly.) The ancient kings of Egypt thus bore as their common and general title an assertion of their divine origin.

PHRASE, in music, a succession of sounds either in melody or harmony, expressing an unbroken sense more or less complete. The art of *phrasing*, so often referred to in criticisms on executive musicians, both vocalists and instrumentalists, is the art of clearly enunciating and gently distinguishing from each other the various phrases which go to make up a piece of music. It is to music what varied and expressive elocution is to reading or recitation, and the absence of it leaves the piece little better than a meaningless sweet congeries of musical sound.

PHRENOLOGY (*Gr. phrên, mind, and logos, discourse*) is, in the words of Dr. Spurzheim, the doctrine of the special faculties of the mind, and of the relations between their manifestations and the body, particularly the brain. The fundamental principles of phrenology, and those in which it chiefly differs from other psychological systems are, that the manifestation of each of the several faculties of the mind depends on a particular part of the brain, and that, *ceteris paribus*, the degree or strength in which each faculty is manifested in each individual depends on the size of its appropriated portion of the brain, or, as it is termed, its organ. Further, phrenologists asserted that the external contour of the skull will be modified according to the internal contour, the latter corresponding with the true shape of the brain; and that therefore the organs of the brain can be traced by feeling or viewing the shape of the head.

The first principle, that of the plurality of organs in the brain, is supported (1) by the analogy of the other compound organs or systems in the body, in which each part has its special function; as, for example, in the digestive system, in which the stomach, liver, and other organs perform each their separate share in the common result of digestion of the food; (2) by the different degrees in which, in different individuals, the several mental functions are manifested; (3) by the phenomena of some forms of mental derangement, in which it often happens that the strength of some of the mental faculties is increased, while that of others is diminished, and in many cases one function only of the mind is deranged while all the rest are performed in a natural manner; (4) by the fact that the several mental faculties are developed to their greatest strength at different periods of life, some being exercised with great energy in childhood, others only in adult age; (5) by the phenomena of dreams, in which only a part of the mental faculties are at rest or asleep, while the others are awake, and, it is presumed, are exercised through the medium of the parts of the brain appropriated to them; (6) by the examination of the brains of individuals remarkable

for some peculiar propensity or talent, in which a constant correspondence has been found in the development of a certain portion of the brain; and that thus the results of the observations upon which phrenology was first founded by Dr. Gall (who died in 1828), exactly coincide with and confirm the arguments by which its truths may, *a priori*, be made to seem probable. Lastly, pain has sometimes been felt in an organ when the faculty with which it is presumed to be connected has been greatly excited; and when a faculty has been morbidly manifested during life disease has sometimes been found to have affected the corresponding part of the brain.

In accordance with these rules Gall enumerated twenty-four organs of mind about the year 1801. Scarcely any of these occupy the same place as in his later system, and four of them (vital force, susceptibility, penetration, generosity as distinct from benevolence) he afterwards

abandoned. In 1810 Gall, aided now by Spurzheim, enumerated thirty primitive mental faculties, which are admitted, with more or less of modification, by all the phrenologists of the present day. They were augmented by Spurzheim to thirty-five, and divided into moral, or affective, and intellectual. The affective faculties or feelings he again divided into *propensities*, including all those which produce only desires or inclinations, and *sentiments*, including such as not only produce a desire to act, but are combined with some other emotion or affection which is not mere propensity. The intellectual faculties also he distinguished into the *perceptive* and the *reflective*. The subjoined figures and the references to them will at once indicate this division of the mental faculties, and the situations on the exterior of the head which are supposed to correspond with the portions of the brain belonging to each, according to the system of Spurzheim.

AFFECTIVE.

I. Propensities.

1. Amativeness.
2. Philoprogenitiveness.
3. Inhabitiveness.
4. Adhesiveness.
5. Combaticiveness.
6. Destructiveness.
7. Secretiveness.
8. Acquisitiveness.
9. Constructiveness.

II. Sentiments.

10. Self esteem.
11. Love of approbation.
12. Cautiousness.
13. Benevolence.
14. Veneration.
15. Firmness.
16. Conscientiousness.
17. Hope.
18. Wonder.

19. Ideality.
20. Mirthfulness, Wit.
21. Imitation

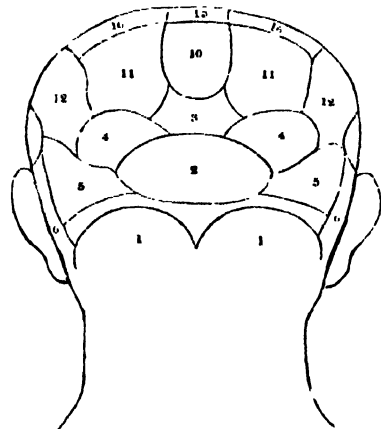
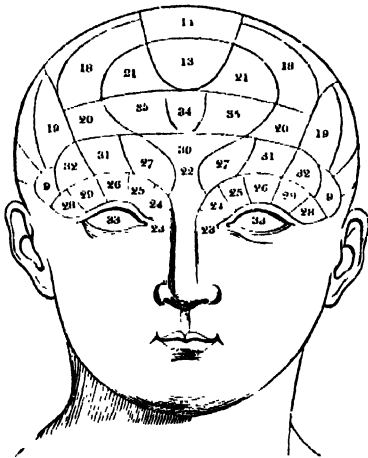
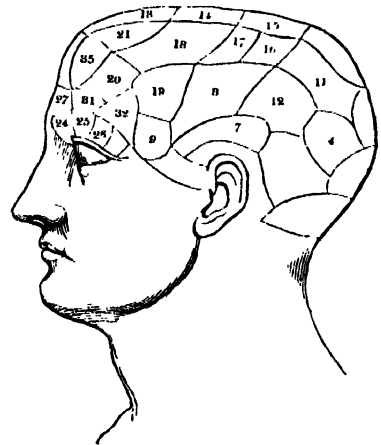
INTELLECTUAL.

I. Perceptive.

22. Individuality.
23. Form.
24. Size.
25. Weight and Resistance.
26. Colour.
27. Locality.
28. Number.
29. Order.
30. Eventuality.
31. Time.
32. Melody.
33. Language.

II. Reflective.

34. Comparison.
35. Causality.



The doctrine of phrenology still remains a *questio vexata*. Men of science are now able to show that its faults, both physical and psychical, are such as quite to put it out of the pale of the real sciences; yet as there are numbers who still place implicit reliance on the leading principles of cranial developments, the subject has been thought worthy of consideration at some length for convenience of refer-

ence. It has been well said that "in phrenology there was much that was both *true* and *new*; but that which was *true* was not *new*, and that which was *new* was not *true*!" Thus the doctrine of mental physiology, as regards the peculiar formation of the head, was evidently acknowledged and understood by the ancient Greeks, as illustrated by their statues and the figures of their gods and heroes; and in

this leading principle of phrenology there may be some truth; but the *wavulating* system of organs is perfectly new and peculiar to modern times.

The Greeks perfectly understood that a prominent frontal development was a manifestation of intellect, and that a low receding forehead and large cerebellum indicated stupidity and strong animal propensities. These principles were also received and promulgated a century and a half since by a German professor named Camper, who indicated



the degree of intellect possessed by men and animals, agreeably to what he styled the *facial angle*, of which the annexed engraving, so far as it regards the human head, is a representation.

Blumenbach, a distinguished philosopher of Gottingen, notices three leading races of the human family, viz., the Caucasian, the Mongolian (inhabiting Central and Northern Asia), and the Ethiopian. Blumenbach gives the preference to the Caucasian race in the scale of intellect. They received the appellation from Mount Caucasus, because it is generally supposed that civilization and the arts first sprang from that quarter of the globe. In the Caucasian race these are the outwardly distinguishing marks of superior intellect: the head is larger, the forehead expanded, and the upper and fore part of it prominently developed. The characteristics of the Ethiopian or Negro race are a low receding forehead, the cheek bones prominent, the jaws narrow and projecting, and the occipital part of the head extremely large; all accompanying an inferior degree of intellect and a preponderating quantity of animal force.

These facts being admitted, it follows that there may be some physiological truth in the doctrine of Camper's facial angle as the measure of mental power, although it must be remembered that between the outer and the inner contours of the skull there is no correspondence, and that especially in the forehead and at the ears large masses of bone and large cavities intervene, so that the shape of the brain is not indicated by the shape of the skull. And even if we were to grant that there may be some truth in the proposition that the frontal development of the cerebrum is indicative of intellect, it does not necessarily follow that an intellectually formed cranium contains a finely organized brain, or that superior mind and genius are its necessary concomitants. In fact, though men of superior understanding are rarely deficient in frontal development, still there are many a fool and many a shallow-pated coxcomb with a finely-developed head, which he has inherited from his parents, while their finer qualities of mind have by the caprices of heredity been refused to him.

It is manifest that the name *Phrenology* (mind-science) is quite a misnomer; the true scientific name would be *Cranioscopy*, that is, investigation of the visible form of the skull. As cranioscopists the phrenologists have done much good; the patient investigations of Gall and Spurzheim have yielded us valuable facts as to the varying contours of the skull. But the sudden jump to founding a comprehensive science of mind, an entire psychology, upon these purely physical data was one of the gravest mistakes ever made by clever men. The consequence is that phrenology has not made one step since their researches over half a century ago, a clear proof if one were needed of the futility of the "science of bumps." In another way

Gall did yeoman's service, namely, in his earlier researches by dissection of the brain, before he so completely identified himself with mere cranioscopy; for this effort to arrive at the connection between mind and brain started anatomists upon a fruitful series of researches, culminating in the splendid discoveries of Ferrier and others [see BRAIN], until at the present day there is no physiologist of repute who does not admit that mental phenomena are directly connected with nervous structure. For all this real and solid advance, we are greatly indebted, firstly, to Gall himself, and secondly, to the necessary investigations to prove the truth or falsity of his great hypothesis. It is hardly easy now to recognize that in Gall's day, though mind was located in the brain, the passions and propensities were referred elsewhere, to the abdominal viscera and what not, even by anatomists as great as Bichat; no one now disputes Gall's correct view, that the brain (with its extensions) is the sole organ of mind. The reader is staggered when in so famous a thinker as Sir W. Hamilton he finds this remark:—"No assistance is afforded to mental philosophy by the examination of the nervous system, and the doctrines founded upon the supposed parallelism of brain and mind are *wholly groundless*."

But these great merits indirectly due to Gall—and in a less degree to Spurzheim also—must be withheld from phrenology. It would be easy to show how the so-called science breaks down on its own ground. An extensive examination of the heads of musicians finds many examples of depressions where "time," "melody," &c., should cause prominences. One of the great examples of the phrenologists is Bidder, whose peculiarly shaped head showed an enormous organ of "number"; but Piesse found an equally wonderful calculating boy named Mangiamale, whose head showed a deep depression at the point fixed on for the organ of "number" ("Médecine et Médecins," Paris, 1857). All the organs can be demolished in this way, simply because Gall and Spurzheim generalized from imperfect and irrelevant data.

Further, the convulsion of the brain recognized by phrenologists as giving "veneration" is very marked in sheep. Knowing as we do the exact persistence of traits in the long line of animal development, it was a fair charge against the phrenologists that no faculty appeared in the sheep to warrant this prominence of veneration. The phrenologists, however, pointed to the respect for authority shown in the way the flock follows the bell-wether, to the gentleness and submission of the fleecy tribe, &c. Unfortunately, directly after this satisfactory explanation it was discovered that both lions and tigers had the same enlarged convulsion also. What then becomes of the respect for authority, the gentleness and submission allotted to the organ? The phrenologists could only stammer forth that in lions and tigers the organ was inoperative.

Again, the mawked way in which phrenologists allot the cerebellum entirely to sexual desire, &c., is fatal to the accuracy of the system. If cranioscopy can go so egregiously wrong in one "bump," it can manifestly fail equally in others. Now although the functions of the cerebellum are still obscure [see BRAIN], yet one thing is quite certain, that it has nothing whatever to do with the sexual instinct or the love of children. The general view is that its action is limited to the co-ordination of muscular movements.

The truth seems to be this: Gall was right in referring mind to the action of nerve substance, and more especially that of the brain, but here he stopped. He mapped out the brain vaguely, not by the convolutions of the brain itself, as of course would be the proper way, but by the brain-case. He localized the jewels by the shape of the casket, instead of by the ornaments themselves. Each of his small regions, whose boundaries had no relation for the most part with the markedly peculiar contours of the brain, he allotted to one function of mind. Now it has

been not difficult to show by collection of examples that, firstly, size of brain does not mean power, the small-headed men often proving cleverer than the big-headed men; and secondly, that brains (or rather brain-cases) of like shapes do *not* work in like fashion. But at the same time it is believed that the brain is the organ of mind, and that in this way: the peculiarity of nerve-tissue in its sensibility; the great surface of the brain, folded up in convolutions merely that it may be packed in smaller compass, represents an extensive sensitive surface, which gives different results according as it is acted upon by different connections. It is as if we took a powerful electric battery and used the force now for light, now for heat, now for motive power, now for magnetism, &c. We could not point to one plate and say, "This is the light-plate," to another and say, "This is the heat plate," &c.; but the whole battery is a vehicle of force, and we apply that force in various ways according to the connections we make it flow through. Applying this simile to the brain it is evident that granting, which is very probable, that certain parts of the brain-substance are allotted to certain functions of thought, the result will be entirely different according as those parts are called into action. Suppose, as an example at random, that one part of the brain is specially endowed with the power of judgment of differences, the musician will use it to appreciate differences of number in the vibrations of tone, the physicist the differences of vibrations of heat, the painter the differences of vibrations of colour, the chemist weighs fractions of a grain by it, even the casuist may weigh scruples, and the logician balances arguments by it, while the statistician by it compares his vast arrays of figures. It is evident that one power, the power of discrimination of difference, would serve for all these uses, according to the manner in which it was evoked. Supposing, further, that our purely imaginary organ were largely developed in two men, it is evident that a faulty connection in one man would leave a brilliant faculty almost useless, while in the better organized brain of the other enables him, with no greater true power, to achieve a world-wide fame. To complete this fanciful suggestion, we may take an analogy from ordinary life. Two men have brains of great poetic power, the smaller man of the two (Wordsworth), by the superior organization of his mind as a whole, becomes one of the greatest poets we have; the greater man of the two (Coleridge), hampered with indolence, with want of method, and in short with inferior organization of his more brilliant powers, further hindered too by sickness (caused greatly by his own weaknesses), has left us nothing but fragments, serving only to show the glorious "might have been."

(The principal treatises on phrenology which the student should consult are, the works of George Combe, Gall, and Spurzheim; Wigan's "Duality of the Brain;" Dr. Laycock, "Mind and Brain;" Bailey, "Letters on the Philosophy of the Human Mind;" Professor Bain, "On the Study of Character.")

PHRYXOS. See HELLE.

PHRYGIA, a country of Asia Minor. Under the early Roman emperors it was bounded on the W. by Caria, Lydia, and Mysia, on the N. by Bithynia, on the E. by Galatia and Cappadocia, and on the S. by Lycia, Pisidia, and Lycæonia. Before the establishment of the province of Galatia by the Gauls who invaded Asia Minor, Phrygia extended as far as the Halys. The northern part of Phrygia Proper was called Phrygia Epictetus, or the "Acquired," a name given to it when it was annexed by the Romans to the kingdom of Pergamos; and the southern part, which bordered upon Mount Taurus, was called Phrygia Paroreion from this contiguity.

Phrygia is a high table-land, supported on the south by Mount Taurus, and on the north by the high range of mountains which runs from west to east under the ancient

names of Ida and Temonon in Mysia, and Olympus in the neighbourhood of Brusa. The southern and eastern portions are covered with salt marshes, rivers, and lakes, which have no visible outlet. The lake called Tatta by Strabo (now Tuzla) is 30 miles long, and supplies an immense quantity of salt. The valley of the Sangarius is noted for its fertility, and all the south-west is fair and populous.

The early history of the Phrygians is very obscure, but they were traditionally supposed to be the oldest people by the Greeks, and many words in their language undoubtedly had a Phrygian origin. They were conquered by Cræsus, and subsequently by Cyrus; afterwards by the successors of Alexander, and finally by the Romans.

In Northern Phrygia was Azani, near the source of the Rhyndacus, where there are now very extensive ruins; Cotyram, now Kutaya; and the Phrygian *Atina*, whose site appears to be doubtful. In the south-east part of Phrygia was Synnada, and in its neighbourhood Docimæa, noted for its marble quarries. In the south-western part of the province stood Celænus, near the source of the Mæander; and Apameia Cibotus, a place of great wealth, and in the time of Strabo second only to Ephesus as a commercial town. South-west of Apameia was Colossæ, where a Christian church existed, to which St. Paul addressed one of his epistles. West of Colossæ stood Laodicea, a large commercial town in the time of Cicero; there was a Christian church here in the days of the apostles. Nearly opposite to Laodicea, to the north of the river Lycus, was Hierapolis, which had mineral springs.

Phrygia is especially interesting on one ground, namely, that it is presumably the cradle of Greek religion and art. It is quite an error to suppose that the wonderful creations of beauty we all know and reverentially admire sprang suddenly into being, even were it from the mighty brain of an *Æschylus* or a *Pheidias*. On the contrary its progress was slow, though it arrived at its greatest perfection with a sudden rush, like the English drama in Shakespeare or English landscape in Turner. Patient study now directs great attention to Phrygia: the numerous antique rock carvings and sculptures, the coins, the admitted Phrygian character of much of the music of the Greeks, for instance the traditional Phrygian origin of the flute, and of much of their religion.

Among the earliest archaic Phrygian monuments distinguished by an almost infantile absence of artistic form is a remarkable figure discovered by Mr. Ramsay in 1882, on the rampart of the city to which the necropolis of Midas belonged. A flight of broad steps leads up to a stone cut into the shape of a semi-circle, and evidently once an object of worship like the stones which symbolized Artemis and Aphrodite at Ephesus and Paphos. To the left is carved the figure which, as a Phrygian inscription shows, represented "Mother Cybele." The face is a mere round disc, the knees project, the shoulders are square—in fact, the figure is little more than a duplicate of the well-known image of the goddess on the northern cliff of Sipylus, in which the Greeks, from the time of Homer, saw the weeping Niobe turned into stone. Not far from the necropolis of Midas, at the modern village of Ayazem, are other tombs, one of which is ornamented with a pair of lions quite remarkably like the well-known pair which adorns the Treasury of Atreus at Mycenæ.

PHRYGIAN MODE, one of the modes of ancient Greek music, corresponding to our scale of E minor with D natural as its seventh, its typical position being an octave below the illustration.

Octave lower.

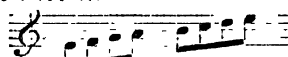


Greek Phrygian (original form).

When Claudius Ptolemy lowered the typical positions of all the scales a fourth, on account of their trying the voice too severely, Phrygian became, of course, our B minor with an A natural. Hypo-Phrygian was the dominant (Greek scale of B, afterwards of F♯); hyper-Phrygian was the subdominant (Greek scale of A, afterwards of B).

In the ecclesiastical modes of the middle ages, which intended to be, but were not, reproductions of the Greek modes, Phrygian was the name given to the octave from E to E, differing from the Greek scale in having an F natural; and hypo-Phrygian was the name given to the octave from B to B (all naturals), which was the "plagal" to the "authentic" Phrygian.

Octave lower.



Ecclesiastical Phrygian.

PHRYNE (Gr. *Phrynē*), a hetaira of Athens, believed to be the most beautiful woman of antiquity, was a native of Thespia in Boiotia. Apellēs painted her as *Aphroditē anadumēnē* (Venus rising from the sea), the most famous picture of the ancients; and Praxiteles, another of her lovers, modelled his statue of Aphroditē for the city of Knidos, which for long years attracted travellers from all parts of the world to that place simply to see it, from the form of this wondrous lady. She was sued once in a law court, but her advocate suddenly unclasping the brooch of her robe allowed it to fall to the ground, and the judges (or as we should now say the jury), struck dumb at the beauty thus revealed, did not dare to condemn so lovely a creature. Phrynē became enormously rich. She seems to have been generous and cultured, but not a truly remarkable woman like the great Aspasia.

It is but just to remark that the hetaira of Greek civilization must on no account be regarded as on a level with her degraded sisters of to-day; on the contrary the profession was not regarded as a dishonourable one, and we know that the virtuous Socrates himself respected and often conversed with Aspasia. One must judge an age by its own manners.

PHRYNICHOS (Gr. *Phrynichos*), one of the earliest Athenian dramatists, is even said to have learned his art from the half-mythical Thespis. His first recorded play dates in 511 B.C., twelve years before the appearance of Aischulos (Æschylus), and at his last, in 476, the great Themistoklēs assisted him, as an inscription recorded. He went to the court of Hiero at Syracuse soon after this date, and died there about 465 B.C.

Phrynichos was always held to be the inventor of tragedy; and he so thoroughly mastered the new art that certain of his subjects were afterwards forbidden, on account of the dangerous excitement they had produced among the audience. He first organized the chorus and introduced masks. The few fragments that remain of Phrynichos are in Bergk's "*Poetæ Lyrici Græci*" (Leipzig, 1843).

PHRYNIDEA is an order of *ARACHNIDA*. The order contains the scorpion-spiders or whip-scorpions, as they are variously called. The abdomen is distinct from the cephalo-thorax, segmented, and in one genus (*Thelyphonus*) narrowed to a tube ending in a long-jointed appendage. The chelicere are two-jointed, with an apical claw, and probably, as in the spiders, contain a poison-gland. The pedipalpi or second pair of appendages are very large, ending in a simple claw or in an imperfect pincer. The first pair of walking legs are very long and slender, and resemble antennæ. These animals breathe by means of four lung-sacs, the openings of which occur in the second and third abdominal segments. There are eight simple eyes. These arachnids are found in the tropics of both hemispheres, and are much dreaded. The species are

generally about an inch in length, but a North American species, *Thelyphonus giganteus*, is 5 inches long. In their general habits they resemble scorpions.

PHTHALIC or **ALIZARIC ACID** is obtained from naphthalene or alizarin by oxidation with nitric acid. It crystallizes in white scales, sparingly soluble in water, but very soluble in alcohol and ether. The formula is $C_8H_6O_4$. It forms, with bases, two series of salts called phthalates, mostly crystalline and soluble, and having the relative formula $C_8H_4M_2O_4$ and $C_8H_3M_2O_4$. It forms two chlorine derivatives, dichlorophthalic acid ($C_8H_4Cl_2O_4$) and trichlorophthalic acid ($C_8H_3Cl_3O_4$). Acted on by ammonia it produces phthalamic acid ($C_8H_7NO_3$). It crystallizes in needles, and on heating is converted into phthalimide ($C_8H_5NO_2$). Phthalic acid, when distilled, produces phthalide ($C_8H_6O_3$), which sublimes in fine needles, melting at 105° C. (221° Fahr.)

PHTHISIS. See CONSUMPTION.

PHULWARA, or the *Vegetable Butter of Almora*, is the produce of the Indian Butter-tree (*Bassia butyragracea*), which grows wild in Nepal and the Almora Hills. The vegetable butter is a fatty, whitish substance, which is squeezed out from the seeds. See *BASSIA*.

PHYCIS is a genus of fishes belonging to the cod family, *GADIDÆ*. The Great Fork Beard or Forked Hake (*Phycis blennoides*) is a Mediterranean species occasionally found on British coasts. The body is over 2 feet in length, of a lilac-gray colour, paler on belly. This fish is distinguished from the Common Hake (*Merluccius*) by having the ventral fins reduced to a single long ray, forked at its end, and by the presence of a barbel under the chin. Five other species are known from the temperate parts of the North Atlantic and Mediterranean.

PHYLACTERY (Gr. *phylaktes*, to guard) is the name used in the New Testament for the sacred badges worn by the Jews, and which are termed in the Old Testament "frontlets" (Heb. *tefillin*). They consisted of strips of parchment on which were written four passages of Scripture, viz., Exod. xiii. 2-10, 11-17; Deut. vi. 4-9, 13-23, which were then rolled up in a case of black calf-skin, which was attached to a stiffer piece of leather, having a thong one finger broad and one and a half cubits long. Two descriptions of phylactery were used, one being placed at the bend of the left arm and one on the forehead, the chief distinction being that those made for the head contained four little cells, one for each of the strips of parchment, while those worn upon the arm had one cell only. The case for the head was made in the shape of a small square box marked with the Hebrew letter *shin*, *w*. For these phylacteries a special ink and the finest vellum were used; and the writing was confined to a certain class of scribes called *Soferim*. In New Testament times they were worn by all male Jews over the age of thirteen, except slaves. The reason assigned for the practice was the injunction found in Deut. vi. 4-9, and though an ostentatious use of this symbol is enumerated among the ill deeds of the Pharisees in Mat. xxiii. 5, the custom itself is not condemned. The use of the phylactery is retained by all devout Jews at the present day, but it is limited to the time of morning prayer on week days. By many of the Jews the phylactery was regarded as an amulet, and the use of sacred words in this way as charms to keep off evil spirits and to afford protection against disease and calamity is very common in the East. At the present day in Syria the practice is almost universal, being followed by Christians and Mohammedans as well as Jews.

PHYULODE is the name given to a flattened leaf-like petiole. It takes the place of leaves in the Australian acacias. The blade or lamina of the leaf is generally not developed at all, but is sometimes found at the summit of the phyllode. Phyllodes stand edgewise on the stem.

PHYLLOPODA is an order of crustaceans belonging to the subclass **EXTOMOSTRACA**. The phyllopods have usually an elongated, distinctly segmented body, the dorsal surface of which, as in *Apus*, is covered in the anterior part of the body by a flat shield-like carapace. The body is, however, sometimes naked, as in *Branchipus*, or inclosed in a bivalve shell, as in *Estheria*. The appendages for the most part are of a simple primitive character, being leaf-like biramous limbs; in some cases (*Apus*) they are very numerous. There are two pairs of small antennae, the posterior of which, in *Branchipus*, is enlarged, and has a prehensile function. The jaws are represented by a pair of large mandibles and two pairs of small maxillae. A large pair of compound eyes is present. The heart is a dorsal chamber, like that of myriapods and insects.

PARTHENOGENESIS is common among the phyllopods. The males of *Apus* were for a long time unknown, and are always rare in proportion to the females. The latter produce eggs, which, without being fertilized, develop into broods of females. The eggs are usually carried about on special appendages or in a brood-pouch of the abdomen. The young are hatched in the nauplius form, with three pairs of appendages. The phyllopods are especially abundant in shallow fresh-water pools, but a few are marine. *Artemia salina* (the brine shrimp) is found in brine pools.

PHYLLOSTOMIDÆ. See **VAMPIRE BATS**.

PHYLLOTAXY, in botany, is the arrangement of leaves on the stem. See **LEAF**.

PHYLLOXERA is a genus of insects belonging to the order **HEMITEIRA** and the family of Plant-lice or Aphididae. The genus is well known from the terrible ravages of a species, *Phylloxera vastatrix*, on the grape-vines in France and the south of Europe. In 1865 a disease of the grape-vines in the vineyards of the lower valley of the Rhone first attracted attention. In subsequent years the disease spread and increased in virulence. In 1868 it was discovered that the disease was due to the attacks of a minute plant-louse upon the roots. The *Phylloxera* of the vine exists in two forms, one raising irregular galls on the leaves, and the other forming small swellings on the rootlets. The one which is hatched as a smooth larva; it subsequently acquires tubercles, becomes of a dull brown colour, and passes the winter in a torpid condition attached to the roots. In the spring it moults, increases in size, and begins laying eggs. The eggs develop parthenogenetically and give rise to other wingless forms, which in like manner produce unfertilized eggs. In this way several generations of parthenogenetic females are produced, till at length, in July, some of the individuals acquire wings, issue from the ground, and flying to fresh vineyards lay their eggs, from two to eight, in crevices in the ground. These eggs hatch in about a fortnight, some giving exit to males, some to females. These sexual forms are incapable of flying or taking food, and the female, after depositing a single egg, dies. This fertilized egg gives rise to a larva, which, after hibernating, lays eggs in the spring, and so the cycle of the life-history is complete. It has been shown by Babbiani that in the latter part of the summer some of the individuals, instead of acquiring wings and seeking the upper air, may underground produce two kinds of eggs, which give rise to male and female forms. The gall-making form is very rare; it resembles the wingless root-form, except in having the body smooth.

The *Phylloxera vastatrix* is a native of North America, where it is found on both wild and cultivated vines, but many American vines are proof against its attacks. Hence it is suggested by some that the only way to save the vineyards of the south of Europe from destruction is to stock them with American vines, or to graft them on the old vines, but as the effect of this would be to alter altogether the character of the wines, it has not met with much

favour. The arrest of this awful plague is a matter of national concern, especially in France, where the government have offered a large reward for the discovery of an effectual remedy. The plague can be checked in two ways, by submersion and by the use of insecticides. But submersion, to be effectual, must continue for some forty or fifty days, the ground being covered by 7 or 8 inches of water; and most vineyards are planted on the slopes of hills, and cannot be flooded except by a costly system of irrigation canals. Of insecticides the best are sulphide of carbon and sulphocarbonate of potash, the former being injected pure into the soil, the latter carried to the roots in solution. After treatment with these the vines must be immediately manured. This treatment is costly, and has not proved so effectual as was hoped, for it is only the young and vigorous vines that survive. During the first year of attack the vine does not show outwardly any signs of disease, except for the knotty swellings on the rootlets. In the second year the *Phylloxera* attack the main roots, and the leaves become sickly and yellow; and in the third year the vine usually dies. In 1886 news reached Europe of the appearance of this scourge in the vineyards of the Cape of Good Hope.

About a dozen species of *Phylloxera* are known in North America inhabiting galls upon the leaves and twigs of species of hickory. *Phylloxera quercus* is found in Europe on the under sides of the leaves of the oak; it reproduces parthenogenetically and has a remarkable life-history.

PHYSALIS is a genus of plants belonging to the order **SOLANACEÆ**. The species are chiefly tropical in both hemispheres, but one is found in Southern and Central Europe. The generic name is derived from the character of the calyx, which increases greatly in size after the corolla falls off, so that the fruit comes to be inclosed in a loose bladder. The calyx is five-cleft, the corolla bell-shaped or wheel-shaped, concealing the five stamens within its tube; the fruit is succulent and two-celled. Some of the species possess medicinal properties. *Physalis sonchifera* has a red smooth berry about the size of a pea, reputed to be narcotic and diuretic. The leaves steeped in oil are in India applied to inflammatory tumours, and they are used in a similar way in Egypt. In the form of an infusion they are employed in fevers. Kunth recognized the leaves of this plant in Egyptian mummies. *Physalis Alkekengi* (the winter cherry) is found in Europe on exposed hills. The corolla is a dirty white; the calyx reddish-yellow, inclosing a scarlet berry. In this country the fruit is seldom eaten, and the plant is cultivated chiefly on account of its appearance. In Arabia and Armenia, Spain and Germany, however, the berries frequently supply the place of other edible fruits.

PHYSIC NUT. See **PURGING NUT**.

PHYSICIAN. The first class of medical practitioners in rank and legal pre-eminence is that of the physicians. They are (by statute 32 Henry VIII.) allowed to practise physic in all its branches, among which surgery is enumerated. But at present the practice of the physician is universally understood, as well by physicians as the public, to be properly confined to the prescribing of medicines, which are to be compounded by the apothecaries; and in so far superintending the proceedings of the surgeon as to aid his operations by prescribing what is necessary to the general health of the patient, and for the purpose of counteracting any internal disease.

In the universities of Oxford and Cambridge the degrees of Bachelor of Medicine and Doctor of Medicine are conferred after the candidate has complied with all the requisite terms.

Since the University of London was chartered, in 1837, the degrees of Bachelor and Doctor of Medicine, among others, have been also conferred there. The regulations

under which these degrees are conferred are printed in the "London University Calendar."

In Scotland the degree of Doctor of Medicine is conferred by the universities of Edinburgh, Glasgow, Aberdeen, and St. Andrews.

In Ireland the King and Queen's College of Physicians exercise much the same authority as the English College of Physicians. The degrees of Bachelor and Doctor of Medicine conferred by Trinity College, Dublin, rank with the same degrees respectively from Oxford and Cambridge.

A physician is exempted from serving on juries and various offices, and from bearing arms. He is responsible for want of skill and attention, and is liable to have an action brought against him by a patient who may have suffered injury by any gross want of professional knowledge on his part.

PHYSICIANS, ROYAL COLLEGE OF, founded through the instrumentality of Linacre, who obtained, by his interest with Cardinal Wolsey, letters patent from Henry VIII., dated in the year 1518. This charter granted to John Chambre, Thomas Linacre, Ferdinand de Victoria, Nicholas Halsewell, John Francis, and Robert Yaxley, that they, and all men of the same faculty of and in the city of London, should be in fact and name one body and perpetual community or college; and that the same community or college might yearly and for ever elect and make some prudent man of that community, expert in the faculty of medicine, president of the same college or community, to supervise, observe, and govern for that year the said college or community, and all men of the same faculty and their affairs, and also that the president and college of the same community might elect four every year, who should have the supervision and scrutiny, &c., of all physicians within the precincts of London. The statute of 11 Henry VIII. confirmed this charter, and further ordained, that the six persons above named, choosing to themselves two more of the said community, should from henceforth be called and cleaved elects; and that the same elects should yearly choose one of them to be president of the same community; and then provide for the election of others to supply the rooms and places of such elects as should in future be void by death or otherwise, which was to be made by the survivors of the same elects. The statute of 32 Henry VIII. provides that from henceforth the president, commons, and fellows might yearly, at such time as they should think fit, elect and choose four persons of the said commons and fellows, of the best learned, wisest, and most discreet, such as they should think convenient and have experience in the faculty of physic, to search and examine apothecaries' wares, &c. This last appointment was independent of the constitution of the body, the persons so appointed being officers for a special purpose; and it became usual to select for this office the same four persons in whom the government of the physicians is reposed by the charter and statute of the 14th of Henry VIII. By this Act it was also provided that the president and college were exempted in consequence of the professional duties "from keeping watch and ward, and from being chosen to the office of constable and other offices;" and it was further declared that "surgery is a part of physic, and may be practised by any of the company of fellowship of physicians." Until very recent times, however, this recognition of surgery was repudiated by the collegiate body, and special rules were devised to give effect to their view of the matter. Other Acts touching the Corporation of Physicians, London, were subsequently passed, but nothing of any great importance occurred until the passing of the Medical Act of 1858, which provided for the granting of a new charter to the college, which was obtained in 1862. In 1860 an Act to Amend the Medical Act was passed by which the provisions of the Act of Henry VIII. (1522-23) as to the elects were repealed, on

the ground that their main function of licensing country physicians had virtually ceased.

The college as at present constituted consists of fellows, members, licentiates, and extra-licentiates. The fellows are elected from members of at least four years' standing, who have distinguished themselves in the practice of medicine or in the pursuit of medical or general science or literature, and the government of the college is vested in the president and fellows only. The members include persons who were admitted as licentiates before 1859, extra-licentiates who have complied with certain conditions, and persons who have attained the age of twenty-five years, having satisfied the college touching their knowledge of medical and general science and literature, and having been engaged in the study of physic for five years, four of which were spent in a medical school recognized by the college. Licentiates are not members of the corporation, and their general qualifications resemble those necessary for ordinary qualified practitioners. They must be twenty-one years of age, and must have been engaged in professional studies for four years before being admitted to examination.

The course of study ordered by the college comprises:—

Anatomy and physiology, the theory and practice of physic, forensic medicine, chemistry, materia medica and botany, and the principles of midwifery and surgery.

With regard to practical medicine, the college considers it essential that each candidate shall have diligently attended, for three entire years, the physicians' practice of some general hospital in Great Britain or Ireland, containing at least one hundred beds, and having a regular establishment of physicians as well as surgeons.

Candidates who have been educated abroad will be required to show that, in addition to the full course of study already specified, they have diligently attended the physicians' practice in some general hospital in this country for at least twelve months.

Candidates who have already been engaged in practice, and have attained the age of forty years, but have not passed through the complete course of study above described, may (under special circumstances to be judged of by the Censors' Board) be admitted to examination upon presenting to the Censors' Board such testimonials of character, general and professional, as shall be satisfactory to the college.

The first examination is in anatomy and physiology; the second includes all that relates to the causes and symptoms of diseases; the third relates to the treatment of diseases.

Those who are approved at all the examinations receive a diploma under the common seal of the college. No candidate can be admitted as a member who is engaged in trade, or who dispenses medicines, or who practises medicine or surgery in partnership, or who refuses to make known when required by the president or censors the nature and composition of any remedy he uses.

The fee for admission as a fellow is 30 guineas, exclusive of stamp-duty; as a member, 30 guineas; and for "the license to practise physic as a licentiate of the college," 15 guineas. It may be added that no fellow, member, or licentiate is allowed to assume the title of Doctor of Medicine unless he be a graduate in medicine of some university.

The meetings of this famous college were first held in Linacre's house in Knight-riders Street, which he bequeathed to the society, and was occupied by its members until the reign of Charles I. They then removed to a house at the bottom of Amen Corner, which Dr. Harvey purchased and presented to them in 1649. After the Great Fire of London a new college was built in Warwick Lane, and opened in 1674. There the meetings were held until 1825, when a handsome building in Pall Mall East was opened, under the presidency of Sir Henry Hallford.

The increasing number of students presenting themselves at the Royal Colleges of Physicians and Surgeons had long exceeded the accommodation at the disposal of these bodies; a conjoint scheme of medical examination was therefore devised, and an "Examination Hall" for both colleges was erected on the Thames Embankment—the foundation stone of which was laid by Her Majesty Queen Victoria on 21st March, 1886. The building provides accommodation for the simultaneous examination of 600 students. See also **STUDENTS**.

PHYSICS. The word *phísike* (Gr. *phúsikê*), or science of nature, might include in one general term all that is called mixed mathematics, natural philosophy, chemistry, and natural history. The title of physician, or student of nature, has become in our language synonymous with one who investigates the origin of diseases and the means of cure; but in the continental languages it still retains the more general signification. Also *physic* (the study of nature) has come to mean the drugs given to cure disorders, or medicines; and it would be difficult to name two more complete departures from etymology. (Our own word is now *physicist*, as representing the old *physician*.)

The plural, *physics*, is always used to mean the study of nature by means of the severer modes of investigation. Some would limit it to the application of mathematics to material phenomena, but the almost universal usage is to distinguish the preceding as mathematical physics, and include under the general term all the sciences of experiment. The main branches of physics—gravitation, motion, expansion, molecular and other forces, hydraulics, sound, heat, light, magnetism, electricity, &c.—are treated of in separate articles, as are also many of the most important physical instruments; and a description of the more important instruments used in connection with the study of these sciences, such as the barometer, thermometer, lens, pendulum, spectroscope, telephone, &c., will be found under those headings.

PHYSIOGNOMY (Gr. *phusíognomonía*) is the art of determining the mental character of an individual by the examination of his countenance. It was sought to be elevated to the rank of a science by the famous Lavater. The circumstance on which the chief and surest indications afforded by the countenance depend, is that when certain feelings or habits are much indulged in, the positions of the features which are associated with them are apt to become permanent. Thus a person in the frequent habit of sneering contemptuously acquires at last a slight curve in his upper lip by the disproportionate size and power of its elevator muscle; he who is often meditating has the slight frown and the contraction of the brows which are commonly associated with deep thought, permanently fixed; he who has his attention constantly alive to the objects around him acquires an expression of vivacity in the openness of his eye and the quickness of the motions of all the muscles of his face; while he, on the other hand, whose thoughts are rarely roused to active efforts, acquires a smoothness of feature and a sluggishness of action in the several parts of the face, which indicate that its muscles have been exercised as rarely and with as little energy as his thoughts. The attempts to codify physiognomy have not been so successful as to encourage a deeper study of it than every one unconsciously engages in during his intercourse with the world; but it remains certain that we have within ourselves large powers of "making our faces," and can improve a plain face into an attractive one or degrade a lovely countenance into an ugly one. In no case is this power more remarkable than in the often observed fact that a devotedly attached couple grow curiously alike as they pass onward in life, and might in their old age be almost taken for brother and sister.

PHYSIOGRAPHY, or PHYSIOGRAPHICAL GEOLOGY, is that branch of science which treats of the

various physical features of the earth's surface, their mode of origin, and the nature of the different agencies by which they are modified. It is a philosophical extension of the branch of study formerly termed *Physical Geography*. See **GEOLOGY** and the special articles, e.g. **MOUNTAINS**, **RIVERS**, &c.; also "Physiography: an Introduction to the Study of Nature," by Professor Huxley.

PHYSIOLOGY, in its widest sense, is the science of animated nature (Gr. *phúsis*, nature), more particularly of the vital phenomena exhibited in nature—in short, the *science of life*. This, however, seems more correctly described by the term *Biology* (Gr. *bios*, life), and therefore in the wide sense of a science of life, the term *biology* tends more and more to replace the term *physiology*, and the latter to confine itself to the systematic study of the separate organs of living creatures, and of the functions of those organs.

Physiology, as now limited, at once divides itself into *animal physiology* and *vegetable physiology*, and the one is as distinct from zoology or the classification of animals as is the other from botany or the classification of plants. Further, animal physiology divides itself into the very important smaller branch of human physiology and the vast field of general animal physiology, usually treated as comparative physiology. The phenomena which physiology deals with are those of germination or birth, of development or growth, of function, of reproduction, and of decay or death. An attempt to show some of the main features which characterize *LIFE* has been made in the article with that title, and the main conclusion arrived at is the cyclic character of life—that life comes from life and gives life in return. It maintains itself by absorption of elements, to provide for growth, to repair waste, and to provide for the secretions which it eliminates; and it propagates itself by the formation of a germ, whether in a seed (as with plants) or an ovum (as with animals), as is shown in the articles **DEVELOPMENT**, **EMBRYO**; but what it is, or by virtue of what force it thus acts, we know nothing. Neither can we trace its origin, as is sought to be proved in the article **GENERATION (SPONTANEOUS)**. The various points usually discussed in human physiology and comparative physiology are treated separately in this work under such articles as **CELL**, **PROTOPLASM**, **BLOOD**, **CARTILAGE**, **BONE**, **TEETH**, **MUSCLE**, **HAIR**, **SKIN**, **NAILS**, **FEATHERS**, **WOOL**, &c.; under **HEART**, **LUNGS**, **LIVER**, **KIDNEYS**, **STOMACH**, **INTESTINES**, &c.; under **CIRCULATION**, **DIGESTION**, **ABSORPTION**, **SECRETION**, **RESPIRATION**, &c.; under **BRAIN**, **NERVOUS SYSTEM**, **EYE**, **EAR**, **NOSE**, **TONGUE**, &c.; and in the various auxiliary articles to which reference is made in those named.

Vegetable Physiology is the science which treats of the vital functions of plants. It is distinguished from vegetable organography, which gives an account of the tissues and organs of plants, chiefly from the point of view of structure, and which, for this reason, is sometimes expressed by the wider term, *structural botany*. It should, however, be constantly remembered, that vegetable physiology cannot be successfully studied without at least a general acquaintance with other important branches of botanical science, such as the classification of plants, and their structural peculiarities. The first of these subjects requires to be known, in order that the true place of a plant in its relations to other plants may be clearly understood; the second, in order to a correct knowledge of the connection between vital functions and specialized aspects of structure. The phenomena of the vital action in plants are associated chiefly with germination, development or growth, and reproduction, or the continuance of the species. Under these general heads there is room for the study of all conditions connected with the germination of seeds, the food of plants, their various movements, spontaneous and induced, the influence of circumstances,

as of light, soil, and climate, the periods of flowering, the duration of life, and the phenomena of decay and death.

A knowledge of the properties of the plant in its simplest form is necessary before dealing with these questions. As in animals, so in plants, the ultimate structural units are "cells" of protoplasm, which are usually combined in various ways to make up an individual. The lowest animals and plants, however, consist of a single protoplasmic cell, which generally possesses the power of locomotion, of taking food into its substance, and of reproducing itself. Between such plants and animals it is impossible to draw an absolute distinction, and many remain on the borderland between the two kingdoms. In the higher plants the cells are combined into "tissues," building up the body of the plant. Even then, in the young condition, the component cells are distinct, each consisting of a mass of protoplasm which contains in its midst a well-marked "nucleus," and dispersed through it food particles of various kinds. The whole cell is bounded by a membrane, the cell-wall, which consists of a carbohydrate called cellulose. This cell-wall was formerly thought to form a closed sac, but it has been recently demonstrated that, in some cases at least, it is penetrated by pores by means of which the protoplasm is continuous from one cell to another. As the growth of the cell goes on, the cell-wall increases considerably superficially by intussusception, and the cell becomes more or less filled with cell-sap, the protoplasm forming a thin layer in contact with the cell-wall. Mature vegetable cells differ exceedingly according to their function, some losing their cell contents entirely, and some even their cell character, being fused with one another to form "vessels." See CELL.

In the higher or flowering plants food is obtained both from the soil and from the air, by means of the roots in the one case and by means of the leaves in the other. The food of a plant consists of the elements carbon, hydrogen, oxygen, nitrogen, sulphur, phosphorus, iron, potassium, calcium, and magnesium; in addition to these, other elements are often found in the ash of plants, such as silicon, which are, however, not essential. The carbon, which forms one of the most important elements of the plant's food, is obtained from the atmosphere through the agency of the green leaves solely in the presence of sunlight. This power of decomposing the carbonic acid of the air and retaining the carbon is due to the presence in the cells of the leaves of a green colouring matter, CHLOROPHYLL. Fungi and other parasites which do not possess chlorophyll, obtain their carbon from organic matter. The next important food element is nitrogen, which is mainly taken up in a soluble form from the soil by the root hairs; and the water containing the organic matter in solution passes up through the wood to the leaves, to be there elaborated and distributed through the soft bast to all parts of the plant. Another source of nitrogen is ammonia, which is directly absorbed by the leaves. Hydrogen is obtained chiefly by the decomposition of water, oxygen is obtained from the air, from water, and from the soil, and the other essential elements from the soil. The food formed in the plant is frequently not consumed at once, but is stored up in tubers, bulbs, seeds, &c. Other substances are formed by the activity of the plant, which are of no use as food; some of them are of no further service to the plant, as ethereal oils, resins, &c., but others, as the honey and colouring matters of flowers, serve to attract insects for the purpose of fertilization. The insectivorous plants, such as the Venus' fly-trap and the sundew, feed on albuminoids, as animals do, by means of a digestive juice.

Plants breathe in exactly the same way as animals, taking in oxygen from the air, and giving out carbonic acid. But, as in the presence of sunlight all the green parts of a plant are vigorously engaged in just the opposite

process, this respiration of plants is more or less masked in the day-time. But that a respiration of oxygen goes on is shown by the evolution of heat in the expanding of flowers, and in the mauling of barley.

In summer the leaves exhale watery vapour through their pores or stomata. This process, which is known as transpiration, attains its maximum when light and heat are greatest. The loss of water in the form of vapour by the leaves causes water to flow very rapidly up from the roots. The "bleeding" of trees in spring when cut across is due not to transpiration, which is then scarcely operative, but to the pressure of the sap up from the roots.

Since green plants can only obtain their carbonic food in the presence of sunlight, light is absolutely essential to maintain life, for no fresh food can be obtained without it. Germinating seeds, tubers, and bulbs, however, grow in complete darkness, because they draw on the supply of food already stored up. In continued darkness all the green parts of plants lose their colour, the green colouring matter being destroyed. A curious result of the deprivation of light is the consequent elongation of the stems of plants; this is attributed to the removal of the retarding influence of light on growing parts. Light also exercises another kind of influence on most organs of plants, causing them to bend towards the source of light; such organs are said to be *positively heliotropic*. Sometimes, however, as in the case of the tendrils of the Virginian creeper, an organ is *negatively heliotropic*—that is, turns away from the light. An analogous influence is exerted by gravity, causing the phenomenon known as *geotropism*. Most main roots are positively geotropic, always growing so that their tips are directed towards the centre of the earth, no matter in what position they may be placed. The "sleep" of plants is an interesting exhibition of another phenomenon of growth. It is caused by an unequal growth on one side of the growing part. Thus, in the case of a flower closing at nightfall, the petals grow more rapidly on the under side than on the upper, so that the under side becomes convex and the flower closes; the reverse takes place when the flower expands again in the morning. The expanding of a bud takes place exactly in the same way. The twining of stems, again, is brought about by the successive growth of all parts of the organ, which results in the revolving of the apex of the stem till it finds some support. This latter phenomenon is known as *circumnutation*. The twining of tendrils differs from that of stems, but is also brought about by inequality of growth. The movements exhibited by the sensitive plant (*MIMOSA*) and a few other plants differ from those already mentioned in being exhibited after growth has ceased, and in being directly brought about by mechanical irritation. See MOVEMENTS OF PLANTS. The REPRODUCTION OF PLANTS is dealt with under that heading.

PHYSODIN, a neutral resinous substance found in one of the lichens, *Parmelia physodes*. It is a white powder, having the formula $C_{22}H_{32}O_8$; melting at 125° C. (257° Fahr.); insoluble in water and ether, but soluble in ordinary alcohol and in ammonia. The same lichen contains also ceratophyllin ($C_{12}H_{12}O_4$), a crystallizable substance soluble in water, alcohol, and ether, and melting at 147° C. (296° Fahr.)

PHYSOSTIGMINE or **ESERINE** is the active principle of the Calabar or ordeal bean, *Physostigma venenosum*. [See CALABAR BEAN.] It is an alkaloid, and usually presents the appearance of a yellow powder; it is soluble in water, alcohol, and ether, and can be obtained in rectangular crystals. It contracts the pupil of the eye and is antagonistic to atropine. It is a virulent poison, but some of the salts, as the sulphate, hydrobromate, and salicylate, are used in medicine in doses of one-sixtieth to one-twentieth of a grain, in coren, tetanus, and ocular neuralgia.

PHYSOSTOMI is an order of fishes belonging to the subclass TELEOSTEI. This order is distinguished from the order ACANTHOPTERYGII, which contains the majority of the bony fishes, by having the fin rays jointed, not spiny; the first ray of the dorsal and of the pectoral fins is, however, sometimes more or less ossified. The ventral fins are absent in the eels and their allies; in the rest of the order they are abdominal in position. The air-bladder, when present, is connected with the alimentary canal by an air-tube. The order Physostomi contains a great number of genera, comprised by Dr. Günther in thirty-one families. The Siluridæ or eel fishes (see Plates, figs. 1-3) are large fishes found in the fresh waters of the tropical and temperate regions; the sheat fish (*Silurus glanis*, fig. 1) is found in European rivers. This family also contains one of the three fishes which possess electric organs. Another large tropical family is Characiniidæ. The Scopelidæ (fig. 4) contain a number of deep-sea forms which have a series of luminous spots arranged on the body. The Cyprinidæ or carp family contains a large number of well-known fresh-water fishes, such as the carp (fig. 5), barbel, chub, gudgeon, tench, loach (fig. 6), &c. The Cyprinodontidæ are small fresh-water fishes found in both hemispheres, the majority of which are viviparous; the anableps (fig. 7) or four-eye is remarkable for having each eye divided into two portions. The Scombroseidæ depart from the usual character of the order by having the air-bladder, when present, unconnected with the alimentary canal; this family contains the garfish (belone) and the flying fish (*Exocoetus*, fig. 8), which is able to take flying leaps out of the water by means of its elongated pectoral fins. The best known of the Esocidæ is the common pike (fig. 9). The Salmonidæ or salmon family (figs. 10, 11) contains the common salmon (fig. 10), trout, charr, capelin, grayling, &c. The Clupeidæ or herring-family contains, like the last, many fishes useful for food, such as the common herring (fig. 12), sprat, pilchard, and anchovy.

The remaining important families form a section, Apoda, of the order Physostomi, characterized by the absence of the ventral fins, and by the scales, when present, being minute and embedded in the skin. The family Gymnotidæ contains the electric eel (*Gymnotus*, fig. 13), found in the fresh waters of tropical America, which possesses a powerful electric organ. The Muraenidæ or eel family (figs. 14-18) contains a large number of fishes, some of which are useful for food, as the common eel (*Anguilla*, fig. 14), the conger eel (Conger, fig. 15), and some remarkable forms, such as the barrel fish (*Saccopharynx*, fig. 17), which is a deep-sea fish, capable of distending its stomach to an extraordinary extent. The Symbranchidæ contain a small number of tropical eel-like fishes. The extraordinary forms placed in the genus *Leptocephalus*, and formerly classed with the eels, are probably larval forms of various fishes which have had their development accidentally arrested.

PHYTEL'EPHAS. See IVORY PALM.

PHYTOLAC'CA is a genus of plants belonging to the order PHYTOLACCACEÆ. *Phytolacca decandra* (the Virginian poke or poke-weed) is a native of North America, North Africa, the Azores, China, and the Sandwich Islands. It has a branching herbaceous stem, 6 to 8 feet high, with

large green or purplish leaves, and flowers borne in long racemes opposite the leaves. The perianth is four-parted, the segments being white; the stamens are ten, and the carpels ten, united in a whorl; the ovary ripens into a dark purple berry, round and flattened at the top, each cell containing a single seed. The poke-weed is found on the borders of fields and clearings in North America; it has been naturalized in parts of Southern Europe as an ornamental plant. This species, like others of the order, is remarkable for its acidity. The leaves are highly acid when mature, but when young are edible if cooked; the young shoots are often cooked and eaten like asparagus. The root is a powerful emetic, and is applied to skin diseases in the form of an infusion or ointment. The berries yield a rich crimson juice, which, though sharing in the active properties of the whole plant, is used to colour confectionery and wine. A tincture of the ripe berries is a popular remedy in the United States for chronic rheumatism. In the West Indies the berries of another species, *Phytolacca octandra*, are used as soap. The young shoots and leaves of several species, as of *Phytolacca acinosa*, are used as vegetables, cooked like asparagus, in the Himalayas.

PHYTOLACCA'CEÆ is an order of plants belonging to the group MONOCOTYLEDONÆÆ. This order contains herbs and undershrubs, natives of the tropical and sub-tropical regions of both hemispheres. The leaves are alternate, simple, entire, with or without stipules, or with persistent thorns at the base of the petioles. The perianth is four to five parted, with the lobes herbaceous, but frequently coloured on their inner surface; rarely the perianth is double; the stamens are either equal and alternate with the segments of the perianth, or indefinite; the ovary is composed of one or of several carpels, distinct or coherent, each with a solitary ovule; the fruit is fleshy or dry. The species are tolerably numerous, and many of them which are remarkable for their acid properties are employed medicinally. The typical genus is *PHYTOLACCA*.

PHYTOPH'AGA is a group of beetles belonging to the section TETRAMERIA. This is a large group of beetles found on plants, feeding chiefly on the leaves; a few species are aquatic, living on water-lilies and other water-plants. In this group the body is short, and the wing-covers usually polished and brightly coloured. The antennæ are linear and short or of moderate length. The larvae are generally found on the same plant as the perfect insect, feeding also on the leaves, causing in some cases great destruction to cultivated plants. They have a short, convex body, covered with a leathery integument, which is sometimes raised on the abdomen into tubercles or spines; the last abdominal segment is usually prolonged into a retractile tube, which is used in walking. In the Hispidæ and Halticidæ the larvae are leaf-miners, living and passing through the pupal state in the interior of the leaves. The larvae of the Helmet Beetles (*Cassididæ*) shelter themselves on the leaves under a little mass of their own excrement. The Colorado Beetle, which is so destructive to the potato crops in the United States, and the Turnip Fly, which is equally baneful to turnips in England, belong to this group. The chief families are Chrysomelidæ, Cassididæ, Hispidæ, Halticidæ, Galerucidæ, Cryptocephalidæ, and Ciceridæ.

END OF VOL. X.

